3.0
AFFECTED ENVIRONMENT

The Affected Environment Chapter describes the present condition of the environment within the Project Area, prior to the initiation of the Proposed Action or any alternative. The material presented here has been guided by management issues identified by the BLM, public scoping, and by interdisciplinary field analysis of the Project Area. The affected environment is characterized for the following resource areas:

- Geology
- Water Resources
- Air Quality
- Soils
- Vegetation
- Wetlands
- Wildlife
- Special Status Species
- Cultural Resources
- Land Use
- Livestock Management
- Recreation
- Visual Resources
- Noise
- Socioeconomics
- Health and Safety

3.1 GEOLOGY

3.1.1 Regional Overview

3.1.1.1 Physiography and Topography

The Project Area is located in the northwestern corner of the Colorado Plateau physiographic province, within the Mancos Shale Lowlands Section of the Colorado Plateau (Stokes 1988). The Mancos Shale Lowlands is bounded by the Book Cliffs-Roan Plateau to the north, the San Rafael Swell to the southeast, and the Wasatch Plateau to the west. The Book Cliffs-Roan Plateau section is a linear system of erosional cliffs, including Book Cliffs, Roan Cliffs and Badland Cliffs (in Carbon County). These cliffs physiographically separate the Mancos Shale Lowlands from the Uinta Basin to the northeast (Stokes 1988). The San Rafael Swell is an anticline approximately 80 miles long and 30 miles wide. Rocks exposed by this uplift range in age from Paleozoic to Cretaceous (Stokes 1988). The Wasatch Plateau is capped entirely by sedimentary rocks and contains several zones of normal faulting that form long, narrow horsts and grabens. Joe's Valley, a notable feature within the Wasatch Plateau, is a graben that divides the Wasatch Plateau from northwest to southeast (Stokes 1988). The steep eastern margin of the Wasatch Plateau, which marks the western margin of the Mancos Shale Lowlands, is an erosional continuation of the Book Cliffs, and is not related to faulting.

The landscape of the Mancos Shale Lowlands is characterized by sloping, gravel-covered pediments, rugged badlands and narrow, flat-bottomed alluvial valleys (Stokes 1988). The most prominent topographic features in the vicinity of the Project Area are the Book Cliffs to the north and the western extension of these cliffs that mark the edge of the Wasatch Plateau. These escarpments are capped by erosionally resistant sandstones of the Price River Formation of the Mesaverde Group and drop away through the remaining members into the Mancos Shale below.

The eastern portion of the Project Area is relatively flat with some lower benches that rise 200 or 300 feet above the general ground level. The lowest elevation in the Project Area is where the Price River crosses the downstream boundary at an elevation of about 5,300 feet above mean sea level (amsl). The land rises westward from the Price River where it is dominated by benches and canyons. These benches, which typically rise 500 feet amsl to the east and from the canyon bottoms, are actually gravel covered pediments (Stokes 1988). Even further west, steep cliffs rise above the Project Area to the Wasatch Plateau. These cliffs are a geographic extension of the Book Cliffs to the north and are capped by the Mesaverde Group. The highest point in the Project Area is along the western project boundary and is about 7,800 feet amsl. The maximum relief of the Project Area is about 2,500 feet.

3.1.1.2 Stratigraphy

Basic knowledge and understanding of the stratigraphic nomenclature and lithology of the area are necessary for meaningful discussions of geologic structures, mineral development and occurrence, groundwater occurrence and movement, geologic hazards, and topography and slope stability. Figure 3.1-1 provides a summary of stratigraphy and lithology of units that either crop out in the vicinity of the Project Area or are present in the subsurface. A map of the surface geology is presented as Plate 10. The following paragraphs describe only those units of particular importance to the proposed project and the description of the affected environment.

The Mesaverde Group forms the cliffs that border the Project Area to the west and north. The Mesaverde Group includes (from top to bottom as shown on Figure 3.1-1) the Price River Formation, Castlegate Sandstone, Blackhawk Formation, and the Star Point Sandstone. The Price River Formation, which tops the steep cliffs to the north and west of the Project Area, consists of gray to gray-brown sandstone beds irregularly interbedded with conglomerates and thin mudstone lenses. The Castlegate Sandstone Formation is a gray or white, quartzose sandstone, locally interbedded with thin conglomerate layers. The Blackhawk Formation is 700 to 1,000 feet of brown, thin to medium bedded, quartzose sandstones with shaley siltstone, shale, carbonaceous shale, and coal interbeds. This is the primary coal producing formation for this region. The Star Point Sandstone is a light brown to brown, quartzose sandstone with interbeds of shale and shaley siltstone. This unit, which generally forms the lowest part of the cliffs adjacent to the Project Area, intertongues with the underlying Mancos Shale, thinning and splitting into three smaller sandstone units east of Helper.

The Mancos Shale crops out over nearly the entire Project Area, with the exception of very small areas along the northwest and west Project Area boundaries where the Blackhawk Formation is exposed. The Mancos Shale, which ranges in thickness from 2,300 to 6,100 feet, consists of six members. The upper part of the Blue Gate Member is a slope-forming, light blue to dark gray shale and shaley siltstone, with minor thin sandstone beds. The Emery Sandstone Member consists of two cliff-forming sandstone units, which are fine grained, light brown quartzose sandstones averaging about 285 feet thick. These two sandstones are separated by a gray, thin bedded shale averaging 35 to 50 feet thick. The Blue Gate Member consists of light bluish or gray, thin bedded shales and shaley siltstones, which resembles the upper Blue Gate Member and is up to 2,000 feet thick. This unit is another slope former. The Garley Canyon Sandstone is a friable, cliff-forming sandstone ranging in thickness from 140 - 220 feet. The Ferron Sandstone Member, consists of alternating fluvial-deltaic sandstones and thick coals. These alternating beds were formed by a repeating series of wave and river dominated shorelines, delta plains, and bog/swamp facies (USDI, BLM 1994). Thus, the coals and sandstones are lenticular, discontinuous, and interbedded with siltstones, shales and mudstones. There are up to 13 coal beds in the Ferron Sandstone, although most areas average only five coal layers (Tabet 1995a). Overall, the Ferron Sandstone is approximately 250 feet thick on the eastern side of the Project Area and thickens to about 490 feet along the western boundary of the project.

The coals average 4 to 9 feet thick, and net coal

thicknesses can be up to 40 feet. These coals are the production target for the Price CBM Project. The Tununk Member is made up of light to dark gray, thin bedded shales and shaley siltstones and ranges in thickness from 400 to 650 feet. Beneath the Tununk Shale Member is the Dakota Group and Morrison Formation as shown in Figure 3.1-1.

The San Rafael and Glen Canyon Groups are the next geologic units of interest to this project. Injection wells would potentially be completed into the following formations: Curtis, Entrada, Navajo, and Wingate. The Curtis Formation and Entrada Sandstone are part of the San Rafael Group. The Curtis Formation is a light-gray to greenish-gray quartzose sandstone with thin beds of conglomerate. It ranges in thickness from 75 to 250 feet. The Entrada Sandstone is below the Curtis Formation and is an orangish-brown to light-brown, medium to thick bedded sandstone. It ranges in thickness from 200 to 300 feet.

The Glen Canyon Group includes the Navajo Sandstone, Kayenta Formation, and Wingate Sandstone. The Navajo Sandstone is a light brown to light gray, massive, crossbedded, quartzose sandstone which has a few thin limestones near the top of the formation. It ranges in thickness from 400 to 1,000 feet in the vicinity of the Project Area. The Navajo Sandstone is the approved disposal zone for water produced in the Drunkards Wash Unit. The Kayenta Formation is a lavender to reddish-brown, crossbedded, quartzose sandstone well cemented by calcium carbonate. It ranges in thickness from 100 to 250 feet and grades into the overlying and underlying units. The Wingate Sandstone Formation is a reddish-brown to brown, quartzose sandstone, well-cemented by calcium carbonate and averages from 350 to 450 feet thick.

3.1.1.3 Structure

Although the Project Area is situated between several significant structural features, the structure within the Project Area itself is quite simple. Strata in this region dip gently (5 to 10 degrees) to the north-northwest from the San Rafael Swell into the Uinta Basin to the north. The Gordon Creek Fault Zone, a system of normal faults, is located in the Wasatch Plateau west of the Project Area. A series of thrust faults are located east of the Project Area, southeast of Wellington.

The San Rafael Swell is a large, elongate anticline that is oriented in a southwest-northeast direction just south and east of the Project Area. Strata on the east flank of this structure dip as steeply as 80 degrees, whereas strata on the west flank dip a more gentle 5 to 15 degrees (Stokes 1988). There are oil and carbon dioxide reserves located at the northern tip of the anticline, where it plunges steeply. These reserves are located just outside the Project Area.

The Uinta Basin is a large, east-west trending, asymmetric syncline which lies to the northeast of the Project Area. Escarpments (the Book Cliffs) related to erosion, not to geologic uplift or faulting, separate the Uinta Basin from the Mancos Shale Lowlands. Similar erosional features mark the division between the Wasatch Plateau and the Mancos Shale Lowlands west of the Project Area.

The Gordon Creek Fault Zone is a series of northeast trending, high angle normal faults and fractures that are the easternmost of the Wasatch Plateau fault zones (Tripp 1989). The Wasatch Plateau fault zones originated as the Great Basin geosynclinal belt subsided relative to the shelf area to the east in what was known as the Basin-and-Range Orogeny (Stokes 1988). The extensional forces that caused this subsidence allowed large blocks to drop along normal faults, thus forming the system of horsts and grabens that now define long narrow valleys, like Joe's Valley, on the Wasatch Plateau. It is generally thought that the down dropping of grabens began 40 million years ago and continues through the present. The Gordon Creek Fault Zone separates the Book Cliffs coal field from the Wasatch Plateau coal field.

The system of thrust faults southeast of Wellington trends northeast, paralleling the northern end of the San Rafael Swell (Waddell et al. 1981; Lines and Morrissey 1983). At the surface, outcrops of the Ferron Sandstone appear to be repeated among the traces of several of these thrust faults (Plate 10). Subsurface data indicate the possible presence of a thrust fault within the Project Area in Section 31 of Township 14 south, Range 10 east. Here 200 feet of the lower Ferron section is repeated (Tripp 1989).

Thrust faulting can enhance as well as decrease fracture permeability. The faulting action breaks up the rocks, which obviously enhances fracturing. At the same time, however, the compressive stresses that drive the upthrown side of the fault (hanging wall) over the downthrown side (footwall) are also acting to close any open fractures. Data from this area seem to indicate an overall increase in fracture permeability to gas (positive production anomalies) (Burns 1995).

3.1.2 Geological Resources

3.1.2.1 Oil

Oil production has not occurred within the Project Area to date despite oil shows reported within the Project Area in the Dakota Group, the Kaibab Limestone, and the Tununk and Ferron Sandstone Members of the Mancos Shale. Production of oil within the Project Area is not considered likely in the future although exploration may continue. There are five oil fields near the Project Area including the Flat Canyon Field, the Ferron Field, the Joe's Valley Field, the Grassy Trails Field, and the Indian Creek Field.

3.1.2.2 Conventional Natural Gas

Conventional natural gas reserves include "resources which may be produced at the surface from a well bore as a consequence of natural pressure within the subsurface reservoir; artificial lifting of oil from the reservoir to the surface, where economically applicable; and the maintenance of reservoir pressure by means of water or gas injection" (USGS, BLM, FS 1990). Conventional natural gas shows have been reported throughout the Project Area in both the Ferron Sandstone and the Dakota Group, including at the Gordon Creek and Miller Creek fields, although no production within the Project Area has been reported. Conventional natural gas is produced west of the Project Area in the Clear Creek and to the south in the Flat Canyon fields. The Clear Creek field produces from the Ferron Sandstone. The Flat Canyon Field, which includes both the East Mountain and the Indian Creek fields, produces from the Ferron Sandstone and from the Dakota Group.

Carbon dioxide production was established at the Farnham Dome field, to the east of the Project Area. Although more than 2 billion cubic feet (bcf) of carbon dioxide was produced from that field, there is no production there currently. Within the Project Area, shows of carbon dioxide have been reported in the Coconino Sandstone, the Sinbad Member of the Moenkopi Formation, and the Kaibab Limestone. No carbon dioxide has been produced to date within the Project Area.

There is a potential for undiscovered conventional natural gas within the Project Area. Stratigraphic traps within or adjacent to the deltaic zones of the Ferron Sandstone have the highest potential for conventional natural gas reserves. New conventional natural gas reserves may also be found in the Dakota Group. There is also the potential to develop the existing Gordon Creek and Miller Creek fields, although it does not appear economically feasible to develop these reserves at this time.

3.1.2.3 Coalbed Methane

Coals in the Mesaverde Group and the Ferron Sandstone Member of the Mancos Shale contain coalbed methane (CBM) reserves. Within the Project Area, CBM is produced from the coals of the Ferron Sandstone, which are classified as high-volatile B bituminous in the northern part of the Emery Coal Field (Doelling et al. 1979).

CBM is produced along with water, carbon dioxide and nitrogen, as organic matter changes into coal (coalification). Some of the water and gasses become trapped as the coal seam is compacted. A coal seam is a dual porosity

medium that consists of a solid matrix containing micropores and a natural fracture system known as cleats. Prior to production, gas-saturated water occupies the cleats, while the bulk of the gas remains adsorbed to the walls of the matrix micropores. CBM reservoirs can contain from three to seven times more methane than a conventional natural gas reservoir because of large internal surface areas (McElhiney 1989). Generally, higher ranked coals contain more trapped methane.

Adsorbed methane is produced from the coal by reducing the hydrostatic pressures (pressure exerted by water at any given point in a body of water at rest) within the formation. The reduced pressures allow the gas to desorb from the coal micropores into the cleat system and flow toward the portions of the formation with low pressure.

CBM projects usually reduce hydrostatic pressures by removing formation water. Several wells are drilled and water is produced until gas begins to desorb from the coal. Initially, large amounts of water are produced before gas can desorb and begin to flow to the well bore. As more and more gas desorbs and is produced at the well bore, less and less water is produced. Finally, gas production declines as water production remains low in the last stages of a well's production.

A portion of the Project Area (about 50 percent) is located within the Ferron Coalbed Gas Fairway, which extends from north of Price to south of Emery (Tabet 1995a). The Ferron Fairway is 6 to 10 miles wide and at least 80 miles long. "Ultimate recoverable reserves for the Ferron coalbed gas fairway are estimated at between 4 and 9 tcf" (UGS 1995).

The Utah Geological Survey estimated the extent and thickness of Ferron coal in Open-File Report (OFR) 329 (refer to Plate 1 in

UGS 1995b). The Ferron coal isopach contours from OFR 329 superimposed on the project land base map are presented on Plate 10A.

Information from OFR 329 indicates that total Ferron coal thickness in the eastern portion of the Project Area is 10 feet or less. A projected total thickness of Ferron coal ranges from 10 to 20 feet (with isolated areas greater than 30 feet) in the central and western portions of the Project Area, and a thinning trend to less than 10 feet is indicated in the extreme northwestern part of the Project Area.

Currently two fields produce CBM from the Ferron Fairway in or near the Project Area: The Drunkards Wash field (of which the Proposed Action is an expansion) and the Helper field. As of the end of 1995, there are 89 producing wells (and 8 coreholes) in the Drunkards Wash Unit and five in the Helper field. Plate 3 Proposed Action shows the approximate location of the existing CBM wells within the Drunkards Wash Unit of the Project Area.

3.1.2.4 Coal

Coal is not currently mined within the Project Area although some coals of the Ferron Sandstone may be considered mineable. Four principal coal fields are located in the vicinity of the Project Area: the Book Cliffs, the Wasatch Plateau, the Emery, and the Northern Emery. The Book Cliffs coal field is located to the north and east of the Project Area and mines the coals of the Blackhawk Formation. The Wasatch Plateau coal field is located west of the Project Area on the Wasatch Plateau. This coal field is also mined from the Blackhawk Formation. The Southern Emery coal field is located to the south of the Project Area and contains coal from the Ferron Sandstone Member of the Mancos Shale. The Northern Emery field is located in roughly the same place as the proposed project. Coal reserves in the Ferron Sandstone in this coal field have been estimated at 2 billion tons based on burial depths of less than 3,000 feet (Doelling 1972; Bunnel and Hollberg 1991).

There is concern that CBM production may preclude future exploration and development of other mineral reserves, especially mineable coal. It is generally understood that conventional natural gas, oil, and CBM production can occur simultaneously without any significant interference. However, the compatibility of CBM and coal mining is not so well established. CBM production involves the liberation of large amounts of methane from the coal seam. To coal miners, the presence of methane in the coal seam is a serious problem and requires significant investment to extract to allow mining to continue safely. By removing the water from the coal seams as part of CBM production the gas hazard to miners would be minimized. CBM production also typically involves the enhancement of fracture permeability by hydrofracturing the coal seam. Hydrofracturing involves injecting a fluid (usually water) and an inert sand into the coal seam at very high pressures so as to force open fractures temporarily with the pressure and to "prop" them open over the long-term with the inert sand.

3.2 WATER RESOURCES

3.2.1 Regional Overview

The majority of the Project Area is located within the watershed of the Price River. A small portion of the Project Area in the southwest is within the Huntington Creek watershed. The Price River traverses the northern portion of the Project Area flowing through the towns of Helper, Price and Wellington. The Price River Canyon topographically separates the Wasatch Plateau from the Book Cliffs. The majority of tributaries within the Project Area drain from portions of the Book Cliffs and Wasatch Plateau. Flow from the Book Cliffs is very small compared to flow from the Wasatch Plateau (Waddell et al. 1981). Huntington Creek flows just south of the Project Area into the San Rafael River. The Price and San Rafael Rivers drain into the Green River which eventually drains into the Colorado River.

Drainages within the western half of the Project Area are more likely to be perennial, or have flow year round, where they approach the higher elevations and amounts of precipitation typical of the Wasatch Plateau. There are four

perennial streams in the Project Area: Miller Creek, Cedar Creek, Gordon Creek and the Price River. Perennial streams are identified on Plate 11 along with a 660-foot wide buffer zone which is discussed in Section 4.2. BLM lease category stipulations do not allow occupancy or other surface disturbance within 660 feet of perennial streams or springs. (Refer to environmental protection measures BLM 4 and 5 in Section 2.2.5.2 and Appendix 1B.)

Similar to the distribution of perennial streams, there are more springs and seeps in the western half of the Project Area. There are springs at approximately 63 different locations west of the center of Range 9 East. and only 27 east of that same reference. This estimate was based on water rights information supplied by the Utah Department of Natural Resources, Division of Water Rights (UDNR 1995b).

Surface water quality also depends on proximity to the higher elevations and higher amounts of precipitation of the Wasatch Plateau. Regionally, the lowest total dissolved solids (TDS) concentrations occur at higher elevations and increase significantly as the streams flow away from the mountains across the saline soils of the Mancos Shale Lowlands.

The geohydrologic units of the Project Area have been categorized into six aquifers and five confining units. The six aquifers are the Quaternary alluvium (actually a group of discontinuous aquifers), the Mesaverde, the Dakota, the lower part of the Morrison, the Entrada-Preuss, and the Navajo-Nugget. The confining units are the Mancos, the upper part of the Morrison, the Curtis-Stump, the Carmel-Twin Peak, and the Chinle-Moenkopi (Freethey and Cordy 1991). Although the Ferron Sandstone member of the Mancos Shale is considered a supply of groundwater in some areas, it is not used as a supply of groundwater within or near the proposed Project Area.

These geohydrologic units are shown on the stratigraphic column in Figure 3.1-1, along with their associated stratigraphic description. Of all the geohydrologic units listed above, only five have any significant potential to be affected by the proposed CBM operation; the Quaternary Alluvium (potential for impacts from any pipe breaks or surface spills), the Ferron Sandstone (loss of water and lowering of head due to water production) and the Curtis Formation, the Navajo-Nugget aquifer and the Entrada Aquifer (increased head due to injection of water produced from the Ferron). Following discussions will focus primarily on these five units.

A trend in regional groundwater flow is from the Wasatch Plateau in the west toward aquifer outcrops and subcrops in the east. Recharge of the Ferron Sandstone occurs primarily along the fault zones of the Wasatch Plateau where precipitation is highest and extensional faulting allows for greater vertical recharge. Recharge to the Navajo Sandstone in the vicinity of the Project Area occurs along approximately 32 miles of exposed Navajo Sandstone on the west side of the San Rafael Swell (Weiss 1987). Groundwater flows through interconnected pore spaces in the formations as well as through fracture systems. Discharge occurs where aquifers are dissected by deep canyons and where aquifers subcrop against the alluvium of the larger creeks. Other than in the highly faulted areas of the Wasatch Plateau, there appears to be little vertical recharge or discharge between aquifers (Freethey and Cordy 1991).

3.2.2 Surface Water

3.2.2.1 Hydrology

Average annual precipitation in the project vicinity ranges from more than 40 inches at the higher elevations of the Wasatch Plateau (9,000 to 12,000 feet amsl) to less than 6 inches at the town of Green River (4,100 feet amsl). The area usually receives more than half of the total annual precipitation during the months from December through April. May and June are generally the driest months (Waddell et al. 1981).

Evaporation rates follow an annual pattern opposite to that of precipitation. The highest evaporation rates usually occur during June, July, and August, while the lowest evaporation rates occur during December, January, and February. More than 30 percent of the total annual evaporation occurs in July, whereas about 3 percent occurs during December, January, and February. Annual evaporation rates average 31 inches per year (Waddell et al. 1981).

The major streams and tributaries in the Project Area experience their highest flows during May, June and July, accounting for 50 to 70 percent of the annual stream flow. These peak flows are the result of melting snow that accumulates in the higher elevations from October through April (Waddell et al. 1981). The lowest flows occur during the winter months when streamflow is more dependent on bedrock discharge (Waddell et al. 1981). Many of the drainages in and near the Project Area are ephemeral, meaning they flow only in direct response to precipitation events such as thunder storms. In the absence of precipitation, these drainages contain only small stagnant pools or are dry altogether. Several of the streams and washes within the Project Area have 100-year floodplains as designated by FEMA. Refer to Section 1.6.2 for a discussion of floodplains.

Upstream from the Project Area, Price River streamflows average 109 cubic feet per second (cfs). Downstream from the Project Area flows in the Price River average 121 cfs. Flows in Huntington Creek average 74 cfs near the town of Huntington. The location of stream gaging stations and streamflow data for the Price River and for other USGS, UDWQ and UDOGM monitoring stations in the vicinity of the Project Area are presented on Plate 11 and in Table 3.2-1, respectively.

3.2.2.2 Surface Water Quality

As previously discussed, regionally the lowest TDS concentrations occur at higher elevations and increase significantly as the streams flow away from the mountains. The highly saline nature of the Mancos Shale, over which the streams flow in the lower elevations, is largely responsible for this change. The concentrations of TDS typically range from 100 to 250 mg/L at the headwaters of streams, whereas concentrations range from 1,000 to 6,000 mg/L in the lower reaches of the streams. TDS concentration data from the Price River for 1985 ranged from 323 mg/L near Helper to 1,193 mg/L downstream of Wellington. TDS concentrations in Huntington Creek ranged from 125 mg/L upstream to 3,950 mg/L downstream in 1976 (Waddell et al. 1981). The San Rafael River is typically slightly more saline than the Price River. TDS concentrations averaged 2,836 mg/L between 1989 and 1994 in the San Rafael River and 2,532 mg/L in the Price River at Woodside (Table 3.2-2). Surface water quality monitoring stations in the vicinity of the Project Area and available water quality data are presented on Plate 11 and Table 3.2-2, respectively.

Salinity standards have been adopted by the states of the Colorado River Basin for different locations on the Colorado River. These standards were set to protect water quality in the Colorado River from, in part, increased salinity due to return flow from agricultural lands. In essence, there can be no increase in salinity of waters flowing into the Colorado River. These standards apply to the Green River and to its tributaries. The standard at Imperial Dam near the Mexico-United States border is 879 milligrams per liter (mg/L). The BLM anticipates this standard will be exceeded by as much as 29 percent as a result of other projects in the Colorado River Basin, not including the Proposed Action (USDI, BLM 1990).

The type of dissolved constituents in the surface water also changes with elevation. Streams in the higher elevations of the Wasatch Plateau are typically calcium-magnesium type waters (i.e., the primary dissolved constituents are calcium and magnesium). As the streams flow across the Mancos Shale lowlands, both as natural flow and as irrigation return flow from highly locally saline soils, they change to sodium-sulfate type waters.

The quality of water in the Price River is protected for designated uses in accordance with the Utah water quality standards (R137-2). The Price River and tributaries, from its confluence with the Green River to Castle Gate below the intake of the Price City wastewater treatment plant are designated as:

- Class 2B - protected for boating, water skiing and similar uses, excluding swimming.
- Class 3C - protected for nongame fish and other aquatic life
- Class 4 - protected for agricultural uses.

The river and its tributaries from Castle Gate to its headwaters are designated as Class 2B and Class 4 and:

I. Class 1C - protected for domestic purposes with prior treatment.

II. Class 3A - protected for cold water species.

Surface water use and water rights are discussed in Section 3.2.5.

3.2.3 Groundwater

3.2.3.1 Quaternary Alluvium

The most accessible aquifers are in the area of the Quaternary alluvium which borders major creeks such as Miller Creek, Gordon Creek and the Price River. Alluvium is deposited by rivers and streams and is typically composed of a highly varied mixture of non-indurated (not bound or hardened by mineral cement, by pressure or by thermal alteration of the grains) gravel, sand, silt and clay. As a result of this textural variability, aquifer properties such as hydraulic conductivity can vary greatly. Hydraulic conductivities for alluvium can range from that of clay, 10^{-6} feet per day (ft/d) to that of gravel, 10^{4} ft/d (Freeze and Cherry 1979). The discontinuous nature of the alluvial deposits together with their inconsistent aquifer properties prohibit them from being considered a regionally continuous aquifer, even though they may be locally significant. The water produced with the CBM is being generated from the coal itself, which is not expected to have such widely varying conductivity values. Therefore, produced water quantities should not vary significantly within the Project Area.

3.2.3.2 Ferron Sandstone Member

The Ferron Sandstone Member of the Mancos Shale confining unit is considered the next most accessible aquifer in the area. The Ferron provides water for domestic uses far south of the Project Area, near the town of Emery, but is not widely used nearer to, or within, the Project Area due to marginal water quality and relatively great depth. Depths to the top of the Ferron Sandstone in the vicinity of the Project Area are estimated to range from 80 feet below ground surface near Wellington to 3,600 feet near Hiawatha (Lines and Morrissey 1983). The concentration of TDS in water from the Ferron Sandstone ranges from 6,500 to 9,000 mg/L. Bicarbonate and chloride concentrations have been measured at 3,500 and 1,500 mg/L, respectively. Usable quality water is defined for oil and gas operations by 43 CFR 3162.5-3(d) as 5,000 mg/l or loss of TDS. By regulatory definition, the BLM does not consider water from the Ferron to be usable.

Similar to the alluvium, aquifer properties of the Ferron Sandstone are very heterogeneous due to its widely varying lithology. Areas where silty sands dominate the lithology are likely to have hydraulic conductivities of about 1 ft/d whereas areas where shale is the dominant lithology are likely to have hydraulic conductivities of about 10^{-6} ft/d (Freeze and Cherry 1979). The discontinuous and lenticular nature of the deltaic deposits together with the unit's highly heterogeneous aquifer properties prohibit the Ferron Sandstone from being considered a continuous regional aquifer.

3.2.3.3 Curtis Formation and Entrada Sandstone

The Curtis Formation is typically 25 to 75 feet thick, a glauconitic quartzose sandstone with thin beds of conglomerate (Doelling 1972, Stokes 1988 and Clark 1928). Although it is generally thought of as a confining unit, permeabilities are sufficiently high that RGC proposes to use it for a small portion of their injection fluids. The Entrada Sandstone Aquifer is approximately 200 to 300 feet thick and consists of medium to thick bedded sandstone (Doelling 1972, Stokes 1988 and Clark 1928). Neither of these units are used for groundwater supplies in the vicinity of the Project Area.

3.2.3.4 Navajo-Nugget Aquifer

The final geohydrologic unit of interest is the Navajo-Nugget aquifer. The Navajo-Nugget Aquifer is made up of the Navajo Sandstone, Kayenta Formation and Wingate Sandstone stratigraphic units. This geohydrologic unit is not important as a water source in the Project Area because of its poor water quality and great depth. However, the Navajo-Nugget Aquifer is used as a water source in areas close to its outcrop, where the water is of better quality.

Regionally, depths to this aquifer range from 2,000 to 12,000 feet (Freethey and Cordy 1991). Regional estimates of TDS in the Navajo-Nugget Aquifer range from 3,000 mg/L in the east to more than 35,000 in the west (Freethey and Cordy 1991). Locally, the Navajo Sandstone is found at depths exceeding 5,500 feet with TDS concentrations more than 172,000 mg/L (RGC UIC permit). The unit's depth and generally poor water quality within the Project Area make the Navajo Sandstone a suitable disposal zone for water produced by the CBM operation from the Ferron Sandstone.

RGC is currently permitted by UDOGM to inject produced water into the Navajo-Nugget Aquifer (Hunt 1995). Aquifer hydraulic conductivity was estimated to be 2 ft/day based on pre-fracture radial flow data in the injection well (RGC UIC permit). This value is consistent with other hydraulic conductivity values reported for silty sands (Freeze and Cherry 1979).

The UDOGM administers UIC permits in Utah. They have the authority to approve UIC permit applications based on federal and state laws, statutes and regulations. Any addition of new injection wells would be permitted through this agency.

3.2.4 Water Use

Water rights in the state of Utah are administered by the Utah Department of Natural Resources (UDNR) (Division of Water Rights. It is the authority of this agency to determine whether or not a water right application or an application to change an existing water right will be approved based on state laws and statutes, including those of the proposed project.

The Project Area is located within water rights areas 91, the Price River drainage, and 93, the Huntington Creek drainage. According to the UDNR, nearly all of the water within these two water rights areas has been appropriated (Page 1995). Only a small amount of water in the Green River within these two water rights areas has not been applied for or filed. All of the surface water flowing through the Project Area has been appropriated (Page 1995). Most of the surface water in the region is diverted for agricultural purposes including irrigation and livestock watering. An illustration of the types of water usage for Carbon and Emery Counties compared to the water requirements for RGC's

Proposed Action is given on Figures 3.2-1(a) and 3.2-1(b).

A water rights search was conducted for the area within the project boundaries and one mile outside the boundary. The water rights search reported 1,280 points of diversion of surface water sources. The most heavily appropriated surface water body is the Price River which had 379 points of diversion on record. Miller Creek and Gordon Creek had the next highest number of points of diversion on record, with 84 and 64 respectively. The water rights search also revealed that the primary use of surface water in the area is related to agriculture. Of the 1,280 points of diversion reported, 72 percent specified stockwatering and/or irrigation as the primary beneficial use for the water.

The water rights search identified springs at 90 different locations (UDNR 1995). Of these, 63 are located west of the center of Range 9E, and only 27 are located to the east (Plate 11).

As with the surface water appropriations, the main use of spring flow is for agricultural uses. Several springs specified domestic use in their list of beneficial uses. Refer to

Appendix 3A-1 for water rights information on the identified springs.

A water rights search was also conducted for bordering townships east of the Project Area near the Ferron Sandstone outcrop belt. A total of 56 springs situated in 8 townships were identified from the search. Information for each spring is provided in Appendix 3A-2 and spring locations east of the Project Area are shown on Plate 11A. This plate also identifies the Project Area and the Ferron Sandstone outcrop belt.

A water rights search for wells within the Project Area and a one mile perimeter reported approximately 205 points of diversion (UDNR 1995). Of these, RGC has water rights for underground wells for the majority of the points of diversion. RGC has no surface water rights associated with these points of diversion (UDNR 1997). The search identified 56 wells that are not owned by RGC, none of which indicate a completion interval deeper than 250 feet. The majority of the water rights are used for industrial, irrigation and stockwatering purposes. Completion depths are not indicated in the Division of Water Rights' database for 25 of the 56 wells.

3.3 AIR QUALITY

3.3.1 Regional Overview

The air quality of a given region is determined by topography, distribution of sources of air pollutant emissions and meteorology. This section presents information on the climate and air quality of the project region, as well as a brief overview of the regulatory requirements related to air quality permitting.

3.3.1.1 Climate

The proximity of the Wasatch Mountains exerts a strong influence on the climatology and meteorology of the area. Areas east of the Wasatch range are characterized by hot, dry summers, and cold, yet dry winters. Air movement at this latitude is predominantly from the west and north-west, year round. However, prevailing wind and dispersion patterns are modified by the complexity of the terrain. Significant diurnal drainage flows (slope and valley winds) can be expected within the Project Area.

The Project Area is subject to prolonged and intense inversions, which occur in both winter and summer. According to the meteorological data obtained for Clawson, Utah, atmospheric conditions typical of inversions (low wind speeds and stable atmospheric conditions immediately before sunrise) exist 78 percent of the time. Inversions are most severe in the winter when snow cover and shorter daylight hours combine to intensify the difference between cold air at the surface and the warmer air mass aloft. Inversions are more frequent and last longer in valleys where air movement is relatively restricted. The depth of the colder air defines the mixing height and determines the volume in which air pollution emissions are confined. Prolonged inversion conditions with low mixing heights create a buildup of pollutants confined in a smaller volume. During summer, the early morning inversions are generally dissipated by sunshine warming the air near the ground. During the winter, inversions may persist throughout the day.

3.3.1.2 Regulatory Setting

The Clean Air Act (CAA) Amendments of 1977, Part D, Prevention of Significant Deterioration (PSD), require that certain new, major stationary sources and major modifications be subject to a pre-construction review, which includes an ambient air quality analysis. Such a review may apply to the operation of some of the compressor stations proposed for this project. PSD review is required if the potential emissions from sources of this type exceed 250 tons per year of any individual pollutant. The air quality assessment includes an estimation of emissions, evaluation of control technologies and assessment of compliance with ambient air quality standards.

The Project Area is classified as a Class II attainment area under PSD regulations. Attainment status means that no state or federal standards are currently being exceeded. Class II PSD increments, applicable state, and federal ambient air quality standards are listed in Table 3.3-1.

Sources having emissions below the PSD major source thresholds are subject to New Source Review (NSR) permitting with the State of Utah. Such sources are required to demonstrate that they will not cause or contribute to a violation of the ambient air quality standards. BLM approval of the project is also dependent on the demonstration of compliance with all regulatory requirements.

RGC would be required to apply for an Approval Order from the Utah Division of Air Quality (UDAQ) prior to initiating construction of any affected air pollution source. UDAQ regulations include fugitive dust controls for roadways and disturbed areas greater than one-fourth acre. If the source is considered “major” or is affected by Federal New Source

Performance Standards (NSPS) an operation permit may be required. UDAQ regulations also restrict open burning.

The construction of a new sand and gravel facility, if required, would also require an Approval Order from UDAQ.

UDAQ also has developed regulations restricting hazardous air pollutants and any request for an Approval Order would be reviewed for potential emissions of any and all hazardous air pollutants.

3.3.1.3 Air Quality in the Project Area

The Utah Division of Air Quality, has statewide responsibility for monitoring air quality. Most monitoring is typically performed in areas where levels of air pollution are anticipated to be significant. There are no active monitoring stations in the vicinity of the Project Area. However, PM_{10} data (particulate matter of 10 microns or less in size) can be obtained from the Sunnyside, Utah station. This is the nearest monitoring station to Price, Utah. Data collected from July 1994 to February 1995 are shown in Table 3.3-2. Concentrations ranged from 11 to 30 micrograms per cubic meter ($\mu g/m^3$) which are below the State and Federal 24-hour ambient air quality standards. Similarly, nitrogen oxide (NO_2) monitoring data were collected at Castledale in 1980-81. Concentrations ranged from 10 to 18 $\mu g/m^3$ for the annual average.

Midway is located in Carbon County, Utah, with an elevation and general exposure similar to the Project Area is expected to be representative of the project location. Air temperatures vary considerably both diurnally and annually throughout the area with midsummer daytime temperatures in the area commonly exceeding 80BF and midwinter night-time temperatures throughout the area commonly below freezing. The temperature extremes measured at Midway in 1990 are a maximum of 95BF during August, and a minimum temperature of -29BF in December.

Meteorological data from this region indicated that the wind blows out of the west and the west northwest more often than any other direction. The combined frequency of these two directions is nearly 15 percent, and the average amount of time the wind blows from any of the other 14 direction is only four percent of the time. The strongest winds blow from the west, with wind speeds exceeding 21 knots. The maximum wind speed from the east southeast is in the 7 to 10 knot range. It must be recognized that wind speeds less than one knot are considered calm. Typically, the wind speed monitoring equipment is not reliable in determining either wind speed or direction at speeds below one knot.

The strong westerly component is exaggerated in the late winter and spring, with much stronger winds occurring in the April through June period. The persistence of the winds from the southwest and south southwest tends to predominate during the later summer (July through September) period, and the northerly component is much stronger during the October through December time period. The location of this project, in the northwestern corner of the Colorado Plateau is generally sloping. The lowest elevation in the Project Area is adjacent to the Price River (5,300 feet). The land rises to the west where it is dominated by benches

and canyons. Further west, the project abuts the steep cliffs of the Wasatch Plateau. The highest point in the Project Area is about 7,800 feet above mean sea level (amsl). This valley terrain can lead to a diurnal flow with warming that occurs during the day resulting in a gentle up valley flow. In the evening as the valley cools, the air will flow back down the valley. This is demonstrated in the relatively slower wind speeds categories in the range of one to six knots. In these two low wind speed categories, a similar persistence can be seen in the west northwest and the east southeast directions.

The general air quality in the Carbon and Emery County region is expected to be good to excellent because of the remoteness of the area, and distance from major urban population centers. The area is in attainment of the Ambient Air Quality Standards (AAQS) for all criteria pollutants. Current visibility is excellent and the visual range exceeds 125 miles (Notar 1997).

There is a network of visual monitors referred to as the Interagency Monitoring of Protected Visual Environments (IMPROVE) network. The data from this network are analyzed by Bill Malm et al., and two reports have been published. The first (IMPROVE 1993) reported on the spatial and temporal patterns, and the chemical composition of the haze in the United States over the period of 1988 to 1991. The second report (IMPROVE 1996) updated the earlier report with additional data. Based on these reports, the Price area, represented by the data for the Colorado Plateau, is one of the regions with the lowest amounts of haze. Monitoring sites located at Arches, Bandalier, Bryce Canyon, Canyonlands, Grand Canyon, Mesa Verde, and the Petrified Forest contribute to the results for this region. The data reported for Alaska, the central Rocky Mountains, and the Great Basin are the only areas represented to have less total extinction, fine scattering, and absorption. The remainder of the 21 regions analyzed are reported to have greater indicators of haze.

No trends were discernible for the Colorado Plateau. Surrounding areas offered conflicting trends. Both Rocky Mountain National Park and Crater Lake demonstrated a significant drop in absorption, while the Grand Canyon demonstrated an autumn increase.

According to UDAQ, no visibility or haze concerns have been identified in the Project Area, and no specific studies have been conducted (Morris 1996).

3.4 SOILS

3.4.1 Regional Overview

Ten general soil mapping units, comprised of 18 soil series, were delineated within the Project Area (Table 3.4-1). Soils in the Project Area occupy varying landforms including narrow valleys, rolling hills, and high mountains with very steep sideslopes. Elevations range from about 5,000 to 7,800 feet, and slopes range from 0 to 70 percent. At the base of the Book Cliffs on the northern boundary and along the western portion of the Project Area are rolling hills to steep mountains with shallow to very deep soils. On outwash plains, the soils have formed in alluvium, colluvium, and glacial outwash derived dominantly from sandstone, shale, and quartzite. The soils on the mesas, benches, and the sides of mesas have formed in residuum and colluvium derived dominantly from sandstone and shale.

The very deep soils on valley floors and alluvial fans along the Price River, Miller Creek, and along the county line have formed in alluvium derived dominantly from sandstone and alkaline, gypsum-bearing marine shale. On the gently sloping to moderately steep shale hills

surrounding the valley floors, the shallow soils have formed in residuum and alluvium derived dominantly from shale and sandstone.

The soils on the upper slopes and crests of gently rolling hills and the intermingled narrow valleys north of Elmo are shallow to moderately deep. These calcareous soils have formed in residuum that weathered from alkaline, gypsum-bearing marine shale, and residuum that weathered from clayey marine shale bedrock.

General and detailed soils information was obtained in a review of the *Soil Survey of Carbon-Emery Area, Utah* (USDA, SCS 1970) and the *Soil Survey of Carbon Area, Utah* (USDA, SCS 1988). Soils maps showing the distribution of the various soil mapping units, physical characteristics of the soils, and major land uses are detailed in these documents and are summarized below for the soil mapping units within the Project Area.

3.4.2 Soil Characteristics

In order to assess potential impacts to soil, detailed soils maps and data were used to identify soils with a high erosion potential, high to very high saline levels, and soils unsuitable for use as reclamation material. Appendix 3B lists the one-hundred and twelve soil mapping units that occur within the Project Area. The physical characteristics relative to determining impacts due to the Proposed Action and alternatives are also included.

Erosion

Erosion is most likely to occur when all or most of the protective plant cover is removed and rainfall washes the topsoil away, which, in turn, can increase sedimentation of down gradient rivers, streams and creeks. The Soil Surveys indicate the potential for water erosion is high to severe for 38 percent (71,994 acres) of the soils in the Project Area (Plate 12). In most instances, these are loams and silty clay loams intermixed with barren shale, rubbleland or rock outcrop found widely distributed throughout the Project Area. Surface runoff from the barren material is rapid and the shallow soils with low permeability are easily eroded.

Soils in the Project Area that occupy steep slopes are more susceptible to erosion because the potential for erosion increases with increasing slope steepness. Within the Project Area, 81 percent (151,980 acres) of the area has slopes ranging from 0 to 10 percent; 16 percent (30,642 acres) has slopes ranging from 10 to 30 percent; 2 percent (4,408 acres) has slopes ranging from 30 to 50 percent; and about 1 percent (1,211 acres) has slopes greater than 50 percent.

Furthermore, 35 percent (66,064 acres) of the Project Area is currently undergoing accelerated erosion due to runoff from occasional summer storms of high intensity, water escaping from broken irrigation canals, or waste water from irrigation that has formed gullies averaging 3 to 10 feet deep, and 100 to 300 feet apart (USDA, SCS 1970).

Erosion potential is rated moderate for 54 percent (101,780 acres) of the soils in the

Project Area. Generally, these are loams and silty clay loams on nearly level to gently sloping hills throughout the Project Area. These soils have a moderate to high percentage of organic matter and, therefore, a higher moisture holding capacity. This can reduce erosion potential and promotes revegetation and reclamation. Only 8 percent (14,476 acres) of the soils in the Project Area are rated low for erosion potential, and are generally found along the Price River and Miller Creek. These soils are loams, silt loams, and silty clay loams on nearly level to gently sloping hills with a much higher rate of permeability and organic matter content. Disturbance of these soils is unlikely to result in increased erosion.

Wind erosion is most likely to occur in areas of arid climates such as those at lower elevations of the Project Area. When the vegetative cover is removed, soils high in fine textured material are easily transported by wind. This results in the displacement or loss of topsoil, increased sedimentation, and impacts to ambient air quality from elevated dust levels (Section 4.3). About half of the soil series in the Project Area have a moderate potential for wind erosion, including most of the soils in Carbon County. The remainder have a low potential for wind erosion. The Natural Resource Conservation Service (formerly the Soil Conservation Service [SCS]) does not rate any of the soils in the Project Area with a high or severe potential for wind erosion.

Salinity

Saline soils (soils containing soluble salts in quantities that impair its productivity for plants) are naturally occurring throughout the Project Area. Saline soils are common in arid regions where inadequate rainfall means there is little or no chance for the excess salts to be leached from the soil. Within the Project Area highly saline soils occur in the nearly level areas that frequently have a high water table, parent material derived from gypsum-bearing marine shale (with accumulated salts) or are fine textured. These conditions reduce the movement of water downward and make it difficult to leach excess salts. When the salt is not leached from the soils through frequent rainfall or irrigation, it is carried upward with water as it evaporates and salts accumulate on the soil surface.

Saline soils pose two potential concerns:

I. Reclamation - Highly saline soils force plants to exert more energy to absorb water, which is usually most damaging to young plants. High concentrations of salt can also affect plant growth by pulling water from plants, and by holding the water in the soil making it more difficult for plant roots to extract the moisture.

II. Erosion of saline soils and increased sedimentation in local streams and rivers. In general, salinity and erosion potential are low for the soils adjacent to the Price River and Gordon Creek. However, many of the streams and creeks that feed into them are susceptible to erosion and sedimentation of high to very highly saline soils. The 1972 Federal Water Pollution Control Act, as Amended (P.L.92-500) prohibits adding salts into rivers and lakes.

Four percent (7,865 acres) of the soils delineated within the Project Area are rated very high for salinity (greater than 16 millimhos per centimeter [mmhos/cm]). The very highly saline soils would be more difficult to reclaim and would likely require revegetation with plant species specifically selected for salt tolerance (Appendix 2F). Additionally, aggressive erosion control measures would be necessary to prevent increased salt loading of regional waters. Most of the very highly saline soils are found in eastern Emery County, with a few small areas scattered throughout eastern Carbon County (Plate 13).

Soils rated moderately to highly saline (4-16 mmhos/cm) occupy 39 percent (73,082 acres) of the Project Area, mostly in the eastern half. These soils would be easier to reclaim, but aggressive erosion control measures are still warranted. Fifty-seven percent (107,303 acres) of the soils are low in salinity (less than 2 mmhos/cm). These soils are primarily found on the western half of the Project Area at higher elevations. Chances for successful reclamation are much greater, and the potential for increased salinity of regional waters would be negligible.

Quality of Reclamation Material

Soils of the Project Area represent a source of cover material for the reclamation of disturbed areas. The potential for each soil series to be used as cover soil in reclamation was evaluated based on physical and chemical characteristics and the criteria shown in Table 3.4-2. Coversoil suitability ratings for each soil series are shown in Appendix 3B.

Within the Project Area, the most limiting factors are: (1) areas of rock outcrops, barren shale, and rubbleland with little or no soil material, (2) excessively saline soils (greater than 16 mmhos/cm) and, (3) gullied lands.

Rock outcrops, barren shale, rubbleland, and riverwash are rated unsuitable for reclamation material because there is little or no soil material available. Seven percent (12,532 acres) of the Project Area is considered unsuitable as a source of reclamation material. These unsuitable areas are distributed throughout the Project Area, but are most notable along the Price River where riverwash is exposed when the water level is low. These areas are subject to deposition and erosion when the water level is high, and support little if any vegetation. Another significant portion of this group is Badlands. These are steep to very steep areas of barren shale associated with the Mancos Shale Formation which are currently undergoing active geologic erosion.

Gullied lands and soils with very high saline levels are rated poor for use as reclamation material due to the increased difficulty of reclamation. As noted above, these areas will require implementation of good erosion control

measures and revegetation with salt tolerant plant species. Thirty-nine percent (73,121 acres) of the Project Area is rated poor for providing reclamation material. Again, the poor rating applies primarily to the eastern half of the Project Area. Fifty-four percent (102,598 acres) of the soils in the Project Area will provide fair to good quality material for reclamation activities (Plate 14).

The most sensitive soils will be in areas where there is a combination of the characteristics discussed above. Plate 15 shows where these characteristics overlap within the Project Area. Soils with a high erosion potential combined with those unsuitable for reclamation material occur on 3 percent (5,277 acres) of the area. Soils with a high erosion potential combined with highly saline soils occur on 14 percent (26,372 acres) of the Project Area.

3.5 VEGETATION

3.5.1 Regional Overview

The Project Area is located in the Canyonlands floristic section of the Intermountain Region (Cronquist et al. 1972). About 90 percent is in native vegetation, mostly sagebrush/grass, salt desert (saltbush-greasewood), and pinyon-juniper woodland.

The eastern half is mostly level or rolling terrain with low benches and the Price River Valley, and ranges in elevation from about 5,400 to about 5,900 feet. The vegetation consists of a matrix of salt desert in uncultivated areas, together with large patches of irrigated agricultural lands and riparian and wetland vegetation. Several urbanized areas are located in the northern portion of the eastern half, including Price, Wellington, Carbonville, and Spring Glen.

The western half consists of a complex of benches, valleys and hills, ranging from about 5,900 to 7,800 feet elevation. Sagebrush-grass occurs throughout on loamy soils and more level sites, while pinyon-juniper woodland occupies steeper slopes and shallow or rocky soils. Riparian and wetland communities occur along some streams.

The northern and eastern boundaries of the Project Area reach portions of the Book Cliffs and the edge of the Wasatch Plateau. Small areas of montane and subalpine forest, mountain shrub, and barren land occur mostly in these areas.

3.5.2 Vegetation Types

The distribution of vegetation types within the Project Area is provided in Plate 16. Table 3.5-1 provides a summary of acres by vegetation type. Plate 16 was prepared using a combination of existing vegetation mapping, aerial photography interpretation, and limited ground reconnaissance. The primary source was GAP data from the State of Utah's Automated Geographic Reference Center, which consisted of vegetation maps prepared from satellite imagery. The existing data were modified by lumping GAP types and by making corrections based on interpretation of aerial photographs and limited field observations.

Each of the vegetation types is described below. Within types, there are variations in soils and associated factors such as topographic position, precipitation, and elevation which result in differences in potential species composition and primary production. Actual composition and production vary based on land use history and climatic conditions.

Sagebrush/grass

The sagebrush/grass type dominates the western half of the Project Area with scattered locations throughout the eastern half. This is the largest community and comprises 79,419 acres (42.2 percent) of the Project Area (Table 3.5-1). This type mostly occurs in semi-arid areas (10- to 14-inch precipitation) on gently sloping (1 to 8 percent) terrain with deep loamy soils, including benches, terraces, alluvial fans, and valley floors from about 5,700 to 7,500 feet. It includes the sagebrush, sagebrush-perennial grass, grassland, and dry meadow cover types from the GAP data.

This vegetation type is characterized by an overstory of sagebrush and understory of grasses, forbs and smaller shrubs. Big sagebrush is the most common shrub, typically forming about 30 percent cover. Other shrub species include broom snakeweed, little rabbitbrush, pinyon pine, prickly pear cactus, curl-leaf mountain mahogany, ephedra, fourwing saltbush and winterfat. Black sagebrush is the dominant browse species in the Poison Springs Bench, which lies in the southwestern portion of the Project Area. Common grasses include blue grama, bottlebrush squirreltail, Indian ricegrass, needle and thread, western wheatgrass, and slender wheatgrass.

Approximately 10 percent of the mapped area of sagebrush/grass consists of former pinyon-juniper woodlands that were chained in the 1970s, on Poison Springs Bench, Horse Bench, Pinnacle Bench, and a few other areas. Crested wheatgrass, big rabbitbrush, and fourwing saltbush have been seeded in these areas as supplemental forage for domestic livestock and big game.

Salt Desert

Salt desert vegetation occurs mainly in the eastern half of the Project Area. It occupies 50,257 acres (26.7 percent), and is the second most widespread vegetation type in the Project Area. This type occurs in arid areas (6- to 10-inch precipitation) on shale hills, alluvial fans, and valley floors at elevations of about 5,400 to 5,900 feet in the Project Area. Sparsely vegetated badlands are present in some areas, and large areas are eroded or gullied. This type includes the salt desert scrub, desert grassland, and greasewood cover types from the GAP data.

This vegetation type is dominated by perennial chenopod shrubs and half-shrubs, and is also known as saltbush-greasewood. Dominant species include shadscale on uplands, mat saltbush and Nuttall saltbush on hills, and black greasewood and big rabbitbrush in saline bottom and along washes. Other characteristic species include Castle Valley saltbush, budsage, horsebrush, snakeweed, and winterfat. Major native grasses include galleta grass, Indian ricegrass, sand dropseed, and alkali sacaton. Extensive areas are dominated by the introduced cheatgrass (Intermountain Ecosystems 1995).

Pinyon-Juniper Woodland

Pinyon-juniper woodlands occur in the western half of the Project Area and in the area north of Price. This plant community is dominated by dwarf conifer trees - juniper at the lower elevations (about 5,500 to 7,000 feet), and pinyon at higher elevations (>7,000 feet). Pinyon-juniper accounts for approximately 33,167 acres (17.6 percent) of the Project Area (Table 3.5-1). It occurs primarily in semi-arid areas (10- to 14-inch precipitation) on shallow or rocky soils on benches and mesas, mountain slopes, side slopes of benches, and outwash plains.

The junipers and pines are similar in height: 15 to 25 feet at maturity. The tree crowns rarely touch in these open woodlands, and form a canopy cover of 15 to 30 percent. Tree height and density are higher on more favorable and higher elevation sites. The understory varies greatly in pinyon-juniper woodlands. Big sagebrush is common and found in woodland openings in deep, loamy soil. Black sagebrush and mountain mahogany are often the dominant understory shrubs in the pinyon-juniper woodland on shallow, lithic soils. Snakeweed and little rabbitbrush are often found in poor range conditions or unsuccessful range improvement areas. Common grasses include Sandberg bluegrass, needleandthread, Indian ricegrass, squirreltail and western wheatgrass. Common forb species include stemless golden weed, oval buckwheat, yellow-eye cryptantha, scarlet gilia, dwarf cateye, brittle pricklypear cactus, claretcup cactus, and heartleaf twistflower (Intermountain Ecosystems 1995).

Riparian/Wetland Communities

Riparian and wetland communities occur along the Price River, adjacent to canals and agricultural areas, and at scattered locations along smaller streams. This community accounts for 5,209 acres (2.8 percent) of the Project Area (Table 3.5-1) and is located mainly on private land.

Wetlands are those areas which are inundated or saturated with water at or near the surface of the soil for a sufficient duration during the growing season to develop characteristic soils and vegetation. Wetlands are protected under the Clean Water Act, as "special aquatic sites," and are described further in Section 3.6. Riparian communities are those developed in response to the influence of soil moisture and microclimatic regimes that are the direct result of influences from streams and other water bodies. Riparian areas may include both wetlands and non-wetlands. The riparian ecosystem is considered valuable for providing wildlife and fisheries habitat, maintaining water quality, stabilizing stream banks, providing flood control, and scenic and aesthetic values. Riparian and wetlands areas are analyzed together in this EIS because they overlap in characteristics, and because detailed information on occurrence of each as separate categories is not available. In addition, areas mapped as riparian/wetland may include adjacent non-riparian bottomland plant communities, particularly greasewood.

Most of the areas of riparian and wetland vegetation occur in the eastern half of the Project Area, adjacent to and downstream of agricultural areas. Sources of water include seepage from ditches and canals, irrigation runoff, subirrigation, and ponding on poorly drained soils. Many of the areas are wet or

saline meadows, and have high water tables throughout much of the year, and many are saline. Common species include Baltic rush, saltgrass, alkali sacaton, sedges, and redtop. Areas with somewhat deeper water tables are dominated by greasewood, saltgrass and kochia (USDA, SCS 1988). Trees such as tamarisk, cottonwood and elms are present in some areas.

Riparian shrublands are present on alluvial fans and stream terraces of the Price River valley floor in the northeastern portion of the Project Area. Lower areas have seasonally high water tables and are subject to brief periods of inundation, while higher areas are dry. Common species include tamarisk, willows, saltgrass, sedges, cottonwood, skunkbush sumac, and rabbitbrush (USDA, SCS 1988).

Riparian plant communities occur along other perennial streams and are best developed in the pinyon-juniper woodlands. Perennial streams such as Cedar and Gordon Creeks are examples of desert riparian streams with narrow floodplains and riparian vegetation. Fremont cottonwood, narrowleaf cottonwood, elm, Russian olive, tamarisk, copperweed, sandbar willow, salt cedar, saltgrass, and horsetail are often found along the stream channels while big sagebrush, greasewood, big rabbitbrush and squawbush are found on the narrow floodplains (Intermountain Ecosystems 1995).

The BLM has mapped riparian areas on areas of federal surface land ownership within the Project Area. Larger areas (10+ acres) of cottonwood and tamarisk riparian areas are mapped along portions of Gordon Creek and its north and south forks, Haley Canyon, Miller Creek, Serviceberry Creek, Price River, and North Spring Canyon, and perennial and annual forbs and grass riparian along portions of Washboard Wash and Sand Creek. Small areas (mostly < l to 5 acres) of riparian vegetation, mainly tamarisk, are scattered in a number of drainages.

Mountain Shrub

Mountain shrub occurs at scattered locations in the northwestern corner of the Project Area and along the edge of the Wasatch Plateau. The total acreage of mountain shrub within the Project Area is about 433 acres (0.2 percent). This type includes the oak and mountain shrub cover types from the GAP data.

This type is dominated by tall deciduous shrub species including serviceberry, Gambel oak, curlleaf mountain mahogany, cliff rose, snowberry, chokecherry and ceanothus. Common grass species include Letterman needlegrass, bluegrass, Indian ricegrass, western wheatgrass, and slender wheatgrass. The height of the shrub cover is 3 to 16 feet, depending on species, site, and recent fire history.

Montane/Subalpine Forest

Montane and subalpine forests occur at a number of locations near the western edge of the Project Area and the eastern edge of the Wasatch Plateau. This type includes the ponderosa pine, lodgepole pine, aspen, ponderosa pine/mountain shrub and spruce-fir/mountain shrub cover types from the GAP data. Altogether they cover 379 acres, or 0.2 percent of the Project Area. They occur primarily on steep and/or sheltered north and east-facing slopes. Species present include ponderosa pine, lodgepole pine, pinyon, juniper, aspen, blue spruce, Gambel oak, snowberry and other mountain shrub species.

Barren

Sparsely vegetated cliffs and slopes are found at several locations on the Book Cliffs and similar geologic formations on the edge of the Wasatch Plateau. They account for only 294 acres (0.2 percent) of the Project Area.

Agriculture

Irrigated agricultural lands are scattered throughout the eastern half of the Project Area, primarily east of Highway 10, and cover approximately 15,478 acres (8.2 percent) of the Project Area. Primary agricultural uses are alfalfa, small grain, irrigated pasture, and corn for silage (USDA, SCS 1988).

Urban

Urban areas include communities such as Price, Wellington, Carbonville, and Spring Glen, and areas disturbed by mining and industrial activity. The urban type covers 3,593 acres (1.9 percent) of the Project Area.

3.5.3 Noxious Weeds

The Utah Noxious Weed Act defines noxious weed as any plant which is determined by the Commissioner of Agriculture to be especially injurious to public health, crops, livestock, land, or other property. Seventeen species have been designated as state noxious weeds, and fifteen have additionally been classified as new and invading weeds which have the potential to become noxious weeds. Each county weed control board has the authority to develop its own list. Each property owner has the responsibility to control noxious weeds on lands in his possession or under his control. County Weed Boards may issue an individual notice requiring control of noxious weeds on a particular property, and can cause weeds to be controlled with all expenses to be paid by the person in the possession of the property. The Utah Noxious Weed Act also requires that machinery be cleaned of noxious weeds before being brought into the state, and prohibits selling or distributing seeds, hay, manure, soil, sod or nursery stock containing noxious weed seeds.

State designated weeds are Bermuda grass, field bindweed, Canada thistle, diffuse knapweed, dyers woad, hoary cress (whitetop), leafy spurge, medusahead, musk thistle, perennial pepperweed (tall whitetop), quackgrass, Russian knapweed, Scotch thistle (cotton thistle), spotted knapweed, squarrose knapweed, and yellow starthistle. New and invading species include black henbane, camel thorn, Dalmatian toadflax, goatsrue, jointed goatgrass, poison hemlock, purple loosestrife, purple starthistle, silverleaf nightshade, St. Johnswort, velvetleaf, water hemlock, wild proso millet, yellow nutsedge, and yellow toadflax. Carbon County has listed dyers woad as a county noxious weed, and Emery County has identified other problem weeds in the county as houndstongue, whorled milkweed, buffalobur, and chicory.

Carbon County has a variety of noxious weeds

that occur throughout the county such as Canada thistle, musk thistle, bindweed (wild morning glory), and quackgrass (Soper 1995). Small infestations of Russian knapweed have been found around Price and a major infestation occurs south of East Carbon City. White top has small infestations in the Price, Helper, and Spring Glen areas. Small infestations of Scotch thistle, dyer's woad, and leafy spurge have been found in the East Carbon City area, Helper area, and Nine Mile Canyon respectively.

Emery County also has infestations of musk thistle and Russian knapweed as well as spotted knapweed, diffuse napweed, and dalmatian toadflax. Buffalobur is another weed of concern but is not identified as a noxious weed (Worwood 1995).

Gas field developments in the Project Area have had minor noxious weed problems in the recent past. A few musk thistle plants were observed and treated by Carbon County weed control personnel in 1995 and 1996 on both RGC and Anadarko facilities (Wise 1996). Gas production facilities are not regularly inspected for noxious weeds by either RGC or Carbon County personnel. Some noxious weed problems have occurred in Emery County from other oil and gas operations in the Buzzard Bench and Cottonwood Wash areas, where musk thistle has required control on some access roads and around well pads (Nielson 1996).

3.5.4 Revegetation

Much of the Project Area has significant limitations for re-establishment of vegetation, including climatic factors such as low and irregular precipitation; soil factors such as shallow depth, high erosion potential, high salinity, steepness and rockiness; and biotic factors such as potentially high livestock and wildlife use and competition from invasive weeds. Other factors affecting success of revegetation include selection of appropriate species and cultivars, mulching, fertilizing, proper seedbed preparation, good implementation and management, and monitoring and retreatment.

A map of reclamation potential based on soil characteristics is presented and discussed in Section 3.4.

The eastern half of the Project Area is arid (less than 10 inches of precipitation per year), and natural moisture may be sufficient for good vegetation establishment in salt desert vegetation only in years of above normal precipitation or other favorable conditions. Re-establishment of vegetation in agricultural, riparian and wetland areas will not be limited by precipitation, and should be successful in any year. The western half of the Project Area has higher precipitation (10 inches or more), which normally will be adequate for seedling establishment.

A seeded area may require 2 to 5 years for grasses and forbs to become established, and shrubs may take 10 to 15 years or longer. Seeded areas are usually more attractive to livestock and wildlife than the surrounding undisturbed areas, and heavy use could damage or eliminate newly established shrubs and

grasses, unless they are protected by fencing. Much of the Project Area is used for livestock grazing (Section 3.11), and large portions are critical or high value big game wintering range (Section 3.7). Revegetation efforts on big game winter range may require planting seedling browse plants and using seedling protectors to ensure successful establishment of shrubs.

RGC has conducted revegetation seedings on transportation access corridors and drill pits in the Drunkards Wash Unit within the Project Area each year since 1992 (Prince 1996). Seedings have been made in the fall, using seed mixes obtained from BLM and modified by UDWR. Most of the revegetation has occurred on Utah School and Institutional Trust Lands, within the salt desert vegetation type.

Revegetation results have not been systematically monitored by RGC or agency personnel. Results from the first year are reported to have been very poor, with limited establishment of seeded species and major invasion by Russian thistle and halogeton. A portion of this area was re-disturbed and revegetated in later years. Results from subsequent years, 1993 - 1995, are reported to have had much better establishment of seeded species and less invasion by undesirable species. Success was greatest in 1994, when there was a wet spring. Since 1993, RGC has used a contractor based in Price for revegetation.

3.6 WETLANDS

Available information on the distribution, abundance and types of wetlands in the Project Area is provided in Section 3.5.2, under Riparian/Wetland Communities. Information on wetlands is limited and consists of BLM mapping of riparian and wetland areas combined on BLM land, and vegetation mapping based on GAP data and aerial photography on other lands. Vegetation mapping also includes wetland and riparian together, and mapped areas were not field checked. The vegetation map is Plate 16.

Wetlands potentially under the jurisdiction of Section 404 of the Clean Water Act are mainly present in the eastern half of the Project Area, adjacent to and down gradient from agricultural areas, and are related to irrigation practices. Smaller natural wetlands may occur along portions of the Price River and other perennial streams, and at seeps and springs. Most wetlands in the Project Area would be considered palustrine emergent or scrub-shrub wetlands, under the classification system used in the National Wetlands Inventory (Cowardin 1979).

Wetlands and other waters of the U.S. such as stream beds are protected under Section 404 of the Clean Water Act, and project facilities within wetlands would require compliance with the regulatory guidelines and permitting requirements of the Clean Water Act.

3.7 WILDLIFE

3.7.1 Regional Overview

The major upland habitats present in the Project Area are discussed in Section 3.5, and include salt desert, sagebrush-grass, and pinyon-juniper. Other habitats present include riparian and wetlands areas, several perennial streams, and cliffs along the edges of benches and the Wasatch Plateau.

The BLM's Price River Resource Area is inhabited by at least 368 terrestrial wildlife species, including 249 birds, 91 mammals, and 28 reptile and amphibian species (USDI, BLM 1982). Many or most of these species can be expected to occur in the Project Area. They include game species such as elk, mule deer, antelope, moose, black bear, and mountain lion; raptor species such as bald eagle, golden eagle, Cooper's hawk, ferruginous hawk, red-tailed hawk, American kestrel, prairie falcon, great horned owl, and burrowing owl; other mammals such as red fox, porcupine, prairie dogs, and skunk; other birds such as mourning dove, rufous hummingbird, common flicker, horned lark, poor-will, tree swallow, white breasted nuthatch, hermit thrush, and mountain bluebird; and amphibian and reptile species such as leopard frog, tiger salamander, western chorus frog, boreal toad, short-horned lizard, tree lizard, garter snake, gopher snake, and great basin rattlesnake.

There are four perennial streams in the Project Area. Miller Creek and Cedar Creek are not known to have any fish. Gordon Creek has cutthroat trout in the headwaters, and mountain suckers in the lower reaches. The lower reaches have few fish because aquatic habitats have been degraded by cattle grazing. BLM has initiated efforts to restore the lower reaches of Gordon Creek for the eventual establishment of a cold water fishery. The Price River from Helper to Wellington has low numbers of fish, including mountain sucker, mottled sculpin, carp, bluegill, speckled dace, and occasional Utah chub. Catfish and chubs occur in the Price River below Wellington (Christopherson 1996), and common carp, channel catfish, bluehead sucker, red shiner, fathead minnow, sand shiner, and green sunfish have been found further downstream in the section between Woodside and the Green River, approximately 30 to 55 miles below Wellington (Masslich and Holden 1995).

Wildlife species or habitat present in the Project Area that may be affected by the Proposed Action or alternative are discussed below.

3.7.2 Big Game

Introduction

Big game habitat within the affected area is classified as critical value, high value, substantial value and limited value range. The Utah Division of Wildlife Resources defines these habitat classes as:

> Critical Habitat: Sensitive use areas that are limited in availability or provide unique qualities for high interest wildlife. These areas constitute irreplaceable, critical requirements for these species.
>
> High Priority or High Value: Intensive use areas that due to relatively wide distribution do not constitute critical values but which

are highly important to high interest wildlife.

Substantial Value: Areas of existence used regularly by high interest wildlife but at moderate levels with little or no concentrated use.

Limited Value: Occasional use areas that are either sparsely populated or that show sporadic or unpredictable use by high interest wildlife.

Critical Winter Range and Security Areas. Big game critical winter range is that portion of the winter range that big game populations are concentrated on during moderate to severe winters due to excessive snow depths. These ranges are typically less abundant than high value winter ranges and summer ranges. For this reason, habitat quality and forage production on critical winter ranges dictate winter survival and thereby determine herd population carrying capacity.

For purposes of analysis in this document, an additional habitat classification was developed for big game. This classification is referred to simply as "Security Areas." These areas were identified jointly by UDWR and BLM based on past experience with big game winter distribution patterns in the affected area.

Security Areas lie entirely within designated critical winter range but are relatively small habitat areas in comparison to critical winter range. They include 19 percent of mule deer and 24 percent of elk critical winter habitat. Because of unique qualities of these areas (optimum mix of quality forage and cover, proximity to natural migration corridors, and presence of topographic features which moderate severe winter conditions), they attract and support concentrated use by big game each winter. Security Areas, though they represent relatively small areas, are considered to be, acre for acre, the most valuable winter ranges for big game.

High Value Winter Ranges. High Value winter ranges are also considered very important to wintering big game. These ranges typically lie between the critical winter ranges and summer range. Big game use high value winter ranges primarily during fall and spring migrations but also during mild winters. Because these ranges do not receive concentrated use and lie at slightly higher elevational ranges, they provide excellent forage conditions. Available quality forage is extremely important to big game during fall and spring migrations. During the fall, quality forage assures big game arrive on critical winter range in optimum physical condition prior to the onset of winter. During the spring, quality forage is important in rebuilding physical condition of big game, particularly females preparing for fawning and calving.

Mule Deer

The Rocky Mountain mule deer occurs throughout the mountains and valleys of eastern Utah. Mule deer populations throughout Utah have historically fluctuated, periodically affected by drought and severe winter weather. Populations in eastern Utah have declined in recent years but are showing signs of recovery. The recent decline is attributed to a severe five-year period of drought (1988-92) followed by a severe winter in 1992-93 which resulted in high mortality.

Three mule deer herd units are located within the Project Area. The Northeast Manti herd (Unit 30) covers the western two-thirds of the Project Area, west of Highways U.S. 6 and SR-10. Mule deer within this unit are migratory and have approximately 251,000 acres of

summer range (above 8,000 feet elevation) and 148,000 acres of winter range. The current harvest objective is 1,400 bucks annually, and the target winter herd size is approximately 14,000 depending on fawn production and winter survival. Range conditions are fair; doe:fawn ratios are poor; and harvest is well under the UDWR objective. In 1993 and 1994 only 469 and 391 bucks were harvested. Mule deer populations fluctuate cyclically and UDWR expects mule deer populations in the Northeast Manti herd unit to recover to the level identified in the Land Management Plan.

The San Rafael herd (Unit 37) covers the southeastern portion of the Project Area. Mule deer within this unit are yearlong residents and utilize approximately 1.6 million acres of limited value year long habitat. The current harvest objective is 100 bucks annually, with a target herd size of 1,000. In 1994, 151 bucks were harvested.

The Range Creek herd (Unit 32) covers the northeastern portion of the Project Area. This herd unit occupies approximately 320,726 acres of summer range, 462,423 acres of winter range and 14,554 acres of year long habitat. The current harvest objective is 600 bucks annually, with a target herd size of 6,000. Winter conditions in 1991 to 1993 reduced the herd significantly, and buck harvest is well below UDWR management objectives. Only 316 bucks were harvested in 1994.

Typically, wintering deer in the Project Area prefer four-wing saltbush and sagebrush vegetation for winter habitats (Fairchild and Smith 1988). The lower limit of wintering areas for mule deer often correlates with the lower end of pinyon-juniper stands (Karpowitz 1984). Critical winter ranges are occupied between November 1 and May 15 in normal years (USDI, BLM 1982). Summer habitat for mule deer consists of Gambel oak and quaking aspen at lower elevations and montane and subalpine forests at higher elevations (Garrott et al. 1987). Summer ranges occupied by mule deer from May 16 to October 31 are generally in better condition than winter ranges. Yearlong ranges in the Project Area have much lower population levels than seasonal ranges and are generally less critical habitat areas (USDI, BLM 1982).

The distribution of mule deer habitat types in the Project Area is presented in Plate 17, and acres within each type are presented in Table 3.7-1. Critical winter range and high value winter range occupies most of the western half of the Project Area, mostly within the Northeast Manti Herd Unit. Critical summer range covers only small portions of the Project Area, on the edges of the Book Cliffs and Wasatch Plateau. Most of the eastern half of the Project Area in the Range Creek and San Rafael herd units is considered to be limited value yearlong range.

Critical winter range is that portion of the range where big game populations are concentrated during moderate to severe winters due to excessive snow depths. During open or light winters where snow depths are not excessive, mule deer are distributed on both the critical and high value winter ranges.

Critical winter range is typically the limiting factor for mule deer herds. This is generally true because summer ranges are more productive in the amount of forage available compared to the forage production of winter

ranges. Summer ranges often comprise larger land areas compared to winter ranges. This is particularly true for the Northeast Manti herd unit. In this unit, ample amounts of summer range are present while winter ranges are quite limited.

Big game security areas include 10,267 acres of mule deer critical winter habitat and 4,553 acres of high value winter range.

Elk

The Rocky Mountain elk historically occupied the entire state of Utah; the largest concentrations occurring in the Wasatch and Uintah mountains (Murie 1951). After being essentially extirpated at the turn of the century, re-introduction efforts were initiated in 1912-1915. Re-introduction was so successful that elk hunting was authorized in 1925 and by 1992 a record harvest of 10,432 elk was recorded (UDWR 1994a).

Elk within the Price Project Area are part of the Manti and Range Creek herd units. The area southeast of U.S. Highway 6 and State Highway 10 is within the geographical boundaries of a third herd unit, the Buckhorn elk herd (Unit 25), but all of the portion within the Project Area is considered to be non-habitat. The Manti elk herd (Unit 23) includes 1.3 million acres of elk range and covers part of five counties. In the Project Area it includes the area west of U.S. Highway 6 and State Highway 10. The herd is well established, and use areas are well known and documented. The management goal of Manti elk herd is to provide a yearlong bull harvest of 1,300 while providing for the harvest of a limited number of mature bulls. This requires an estimated post season herd size of 11,000 elk. In 1994, 1,050 bulls and 865 anterless were harvested. Drought conditions and poor forage production on critical winter range in Carbon and Emery counties has occurred over the last several years. However, elk populations are at the target level specified in the Manti Elk Herd Management Plan.

The Range Creek elk herd unit (24) covers the area northeast of U.S. Highway 6 in the Project Area. The herd unit includes portions of six Utah counties, and 163,684 acres of elk range. Management objectives are to reduce wintering elk numbers to 400 to 500 elk west of Soldier Creek Road and to increase wintering elk to 800 elk east of Solider Creek Road. Harvest in 1994 was 28 bulls (Bates 1995).

Studies in Wyoming (Murrie 1951, Anderson 1958, Ward et al. 1975), Colorado (Boyd 1970), and Montana (Knight 1970) have shown that elk winter ranges often are confined to the lower elevations along foothills, edges of valleys, and steep, rough canyons where sagebrush-grassland vegetation types predominate. Generally, elk within the Project Area winter at higher locations than deer. Wintering elk were generally found in areas with chainings and burns (Karpowitz 1984). Preferred elk summer range consists of moist sites interspersed with other necessary habitat components such as various timber types forest openings, and appropriate topography (Lyon 1975).

The distribution of elk habitat in the Project Area is shown in Plate 18, and acreage summaries are presented in Table 3.7-1. Most of the western half of the Project Area is critical or high value winter range in the Manti herd unit. Substantial value winter range extends east and south to State Highway 6 and to just north of Price. The southern two-thirds of the Range Creek herd unit within the Project Area are considered to be limited value habitat. Small areas of critical summer and critical

yearlong habitat occur on the northwestern and western edges of the Project Area, along the Book Cliffs and the edge of the Wasatch Plateau.

Security areas include 7,257 acres of elk critical winter habitat, and 7,553 acres of high value winter habitat.

Pronghorn Antelope

Pronghorn antelope live in open terrain, primarily grasslands and grassland-brushlands. The antelope in the Project Area are part of the Icelander Wash herd unit (No. 11) which covers 793,600 acres in Carbon and Emery Counties (UDWR 1994a). The distribution of antelope habitat in the Project Area is shown in Plate 19, and acreages of habitat are provided in Table 3.7-1. Pronghorn antelope occur mainly in the salt desert vegetation type within the Project Area. High value yearlong range occurs east of State Highway 10 and the town of Price, and potential habitat is present west of State Highway 10. Critical yearlong habitat occurs about one-half mile east of the Project Area. Antelope harvest within the Icelander Herd in 1993 was 25 bucks. There are currently about 50 antelope in the area north of Wellington, and about 150 south of Wellington (Bates 1996a). The population is expanding, and may eventually occupy the potential habitat west of Highway 10. There are right-of-way fences along both sides of the highway which restrict their movement. In the winter of 1992-93 antelope crossed the fences and highway when they were snow covered, and they may cross under other circumstances.

Moose

Moose are largely browsers, eating the stems, bark, and leaves of a multitude of trees and shrubs. Important foods include willow, fir, and quaking aspen. The distribution of moose habitat in the Project Area is shown in Plate 19, and habitat acreages are presented in Table 3.7-1. Limited value winter habitat is present in the northwestern portion of the Project Area, and along the edge of the Wasatch Plateau at the extreme western edge of the Project Area. Moose habitat within the Project Area is not within a designated UDWR herd unit, and no specific management objective has been identified.

Black Bear

Black bears are most common in montane shrublands and forests and subalpine forests at moderate elevations, especially in areas with well-developed stands of oakbrush or berry-producing shrubs such as serviceberry and chokecherry (Fitzgerald, Meaney, and Armstrong 1994). The distribution of bear habitat in the Project Area is shown in Plate 19, and acres of habitat are presented in Table 3.7-1. High value yearlong bear habitat occurs in the northwestern portion of the Project Area and along the edge of the Wasatch Plateau in the extreme western portion of the Project Area. The most important habitats include riparian corridors along perennial streams at higher elevations.

Mountain Lion

Mountain lions are most common in rough, broken foothills and canyon country, often associated with montane forests, shrublands, and pinyon-juniper woodlands (Fitzgerald, Meaney, and Armstrong 1994). Within the Project Area, they are likely to be most common in the western half where there is more cover and broken terrain, and where there are populations of wintering mule deer.

Mountain lion are closely associated with mule deer, their principal prey, and critical habitat for mountain lion is assumed to be similar to deer critical habitat. Within the Project Area, critical habitat for mule deer would include a large portion of the area west of Highways US 6 and SR-10 (Plate 17). This area is part of the East Manti Cougar Management Unit. The average annual sport take between 1989 and 1996 from this unit is 15 mountain lion (Evans and Blackwell 1996). The area north and east of Highway 6 is part of the Range Creek Unit, and the area south and east of Highways 6 and 10 is part of the San Rafael Unit.

3.7.3 Raptors

Information on raptor nests was obtained during helicopter surveys of the Project Area and a buffer zone extending one mile outside the Project Area (Parrish 1995). Nest histories were compiled based on these surveys and from historic information (as far back as 1980) on raptor nests obtained from BLM, UDWR, and USFWS. Nest chronologies and surveys were completed at the request of BLM, in order to comply with the Price River Resource Area Management Framework Plan (MFP). The distribution of historic and recently active nests in the Project Area are shown in Plate 20. Nests shown as historic include nests not known to be active from 1993-1995, and nests for which information from this period is unavailable.

At least eight raptor species regularly occur and nest within the Project Area: golden eagle, Cooper's hawk, red-tailed hawk, ferruginous hawk, American kestrel, prairie falcon, peregrine falcon, and great horned owl. Bald eagle occurs within the Project Area in the winter. Bald eagle, ferruginous hawk, and peregrine falcon are discussed in Section 3.8, Special Status Species, and the other raptors are discussed below.

Golden Eagle

Historically, approximately 25 nesting pairs of golden eagles have maintained territories within the Project Area, and at least 163 nests have been recorded (Parrish 1995). Three nests were active in 1994, of which one fledged young, and an additional 8 nests were tended by golden eagles in 1994 (Parrish 1995). The low occupancy and reduced nesting activity in 1994 may be a result of changes in available prey base, a response to weather conditions, or both. Golden eagles in Utah maintain an average of 4-6 nests within a given nesting territory.

Golden eagle nests are usually located on cliffs overlooking large open expanses of grass-shrub or shrubsteppe habitat. In addition, large expanses of sagebrush are preferred in winter (Fischer et al. 1984), and tree nesting occurs in portions of the breeding range, including Utah (Palmer 1988). Within the Project Area, golden eagle nests have been recorded from numerous locations, mostly in the western half, on cliffs of canyons, benches, the Book Cliffs, and the edge of the Wasatch Plateau.

Cooper's Hawk

Cooper's hawk nest and forage in wooded habitats. Suitable nesting habitat for these species are the wooded riparian zones associated with perennial streams, especially Gordon Creek, Miller Creek, Cedar Creek, and the Price River. Two active Cooper's hawk nests were found during raptor surveys, both in riparian habitat and oakbrush near streams (Parrish 1995).

Red-tailed Hawk

This is one of the most common raptor species in North America, and uses a wide variety of habitats. Suitable nesting and wintering habitat for red-tailed hawks occurs throughout the Project Area. At least seven red-tailed hawk territories have historically occurred, and two were active in 1994 or 1995 (Parrish 1995). They are known to nest in pinyon and juniper trees in the pinyon-juniper zone, deciduous trees along riparian habitats, and on cliffs.

American Kestrel

Kestrels inhabit open terrain from sea level to approximately 13,000 feet in elevation, including plains, deserts, agricultural and old fields, meadows, and unforested portions of mountainsides where adequate prey and perching sites are available. This is an ecologically very versatile species. Old woodpecker holes or other cavities are generally preferred for nesting. One kestrel nesting territory is known to occur on a cliff within the Project Area and additional nesting territories undoubtedly occur within the Project Area (Parrish 1995).

Prairie Falcon

Typical habitat of prairie falcons consists of open, treeless terrain in generally arid habitats. Sagebrush desert and desert grasslands with nearby cliffs and rock outcrops suitable for nesting are generally preferred (Palmer 1988, Johnsgaard 1990). Eggs are typically laid along on rocky ledges in cliff habitat, or sometimes in old abandoned stick nests, such as golden eagle nests. Seven historic nest sites are known from within or near the Project Area, but none of these were known to be active during 1994 or 1995. Suitable habitat for nesting occurs in other parts of the Project Area, especially along the western boundary.

Great Horned Owl

Nesting occurs in wooded habitat, and usually occurs near water and open habitats which afford good foraging. One great horned owl nesting territory is known, from just outside the Project Area boundary, and appears to have been active in 1994. Additional great horned owl nests are probably present in the Project Area.

3.7.4 Upland Game

Sage Grouse

The sage grouse is a large upland game bird that is totally dependent on the sagebrush ecosystem for successful breeding, nesting, and winter survival. Sage grouse are not abundant in the Project Area, but approximately 31,529 acres of yearlong habitat is present (Plate 19A). Sage grouse are known to have occurred in the western portions of the Project Area, but have not been observed in recent years (Mills 1996). Lower bench areas such as Porphyry Bench are known to have supported wintering sage grouse, and upper benches such as Horse and Telephone Benches have also been used by sage grouse in past years. Sign typical of that associated with leks has also been found, and sage grouse have been observed strutting on Telephone Bench. The lack of recent sign in the Project Area may be related to regional population cycles and/or trends, with regional populations currently being low. Telephone Bench, Cedar Bench, Horse Bench, Bob Wright Canyon, Long Bench, and Wiregrass Bench are considered by UDWR to provide excellent sage grouse habitat.

Helicopter surveys for strutting grounds were conducted in the spring of 1995 for this EIS, and no signs of sage grouse or sage grouse strutting grounds were observed (MDG and Associates 1995a). However, no on-ground survey work was completed.

Desert Cottontail

Desert cottontails occur in wide variety of habitat types, including open plains, montane and semidesert shrublands, pinyon-juniper woodlands, riparian areas, and woodland/ shrubland edges (Burt and Grossenheider 1980). In southeastern Utah, cottontails are common in desert and submontane elevations and ecosystems, especially sagebrush-grass and agricultural land (Dalton et al. 1990). Breeding usually occurs several times from February to July. Carbon and Emery Counties accounted for 6.09 and 5.00 percent of the state's harvest in 1995 (UDWR 1995). Harvest and roadside count data for the state of Utah indicate that cottontail population numbers are in a statewide decline, because of a severe winter in 1992-1993 and seven years of drought.

Chukar

Chukars were introduced to the western states in the 1930's and have since become well established throughout much of the west. Found primarily in arid regions, chukars inhabit rocky, grassy, or brushy slopes and creek bottoms in mountains and rugged canyons of desert and submontane elevations (Dalton et al. 1990). In 1995, Carbon and Emery Counties represented 0.93 and 6.86 percent of the statewide harvest (UDWR 1995). Long-term harvest and production trends indicate that chukar populations are relatively stable in Utah.

Ring-necked pheasant

Pheasants are found primarily in open country, cultivated areas, marsh, woodland, and forest edge habitats, roosting in weedy ditches, marshes, weed-grown fence corners, and brush heaps. In southeastern Utah, they occur in desert and montane elevations in agricultural marsh, wet meadow, and riparian ecoystems (Dalton et al. 1990). Carbon and Emery Counties represented 1.06 and 2.13 percent of the state's harvest in 1995 (UDWR 1995). Long-term trends based on harvest data indicate a recent trend toward fewer hunter-days with declines in total pheasants harvested and hunter success (UDWR 1995). Pheasant populations are decreasing due to habitat loss, degradation, and fragmentation (UDWR 1995, Dalton et al. 1990).

3.7.5 Other Mammals

White-tailed Prairie Dogs

Numerous species are affiliated with prairie dog colonies and are dependent on them for food, cover and breeding habitat. Several of the species dependent on prairie dogs are threatened, endangered or sensitive species, including black-footed ferret, ferruginous hawk, and burrowing owl. Because prairie dogs are pivotal in the functioning of ecosystems, they are sometimes considered a keystone or critical link species. Keystone species significantly influence the distribution, abundance, and/or diversity of other species (Finch 1992).

Four areas of white-tailed prairie dog activity are known to occur in the Project Area, totaling 31 colonies occupying 6,865 acres (Plate 19A).

Individual colonies are generally continuous in available habitat and are usually separated from each other by topography or landscape features such as long sandstone ridges and broad washes (MDG and Associates 1995b).

3.7.6 Waterfowl and Shorebirds

Waterfowl and shorebird use of the Project Area is limited to minor areas of suitable habitat along the Price River and at small stock watering reservoirs and irrigation ponds. Price River has steep cutbanks along most of it, and may be used principally during the fall when stock ponds and lakes are dry (Weaver 1997). Minor use during migration has also been reported at the RGC evaporation pond in T15S, R9E, S1. The nearest major waterfowl and shorebird habitat is Desert Lake Waterfowl Management Area, located approximately two miles from the southeastern edge of the Project Area. Olsen Reservoir, about 8 miles northeast of Desert Lake and 3 miles east of the Project Area, has limited waterfowl use (USDI, Bureau of Reclamation and USDA, Soil Conservation Service, 1993).

Desert Lake Waterfowl Management Area (WMA), supports a variety of migrating and nesting birds. Desert Lake WMA is managed by the UDWR primarily for waterfowl and secondarily for upland game. Other game and non-game animals such as deer, prairie dogs, beavers, and a variety of shorebirds, songbirds, and raptors are also included in management efforts (UDWR 1988). Prior to 1971 Desert Lake consisted of a single, natural lake. It has since been excavated and expanded to include eight pond units. Currently, Desert Lake WMA consists of 3,000 acres, one-quarter of which is comprised of marshland. Oat, wheat, corn, and sorghum croplands cover between five and ten percent of the WMA. The remainder consists of upland desert habitat dominated by Indian ricegrass, shadscale, rabbitbrush, and snakeweed.

Information on birds potentially occurring at Desert Lake WMA was obtained from Weaver (1997), UDWR (1988) and Dalton et al. (1990). During the spring and fall migratory periods (usually early March and late August through early October) Desert Lake is an important stopover site for migrating birds, providing water, food, and cover amid the rather inhospitable salt desert landscape. The most common migrants are probably pintails and mallards, followed by green-winged teal and coots. Other migrant waterfowl species commonly observed at Desert Lake include tundra swans, snow geese, American widgeon, canvasbacks, ring-necked ducks, and common and red-breasted mergansers. Migrant shorebirds commonly seen include both greater and lesser yellowlegs, red-necked phalaropes, short-billed dowitchers, and western and least sandpipers. Gulls and terns such as ring-billed gulls and black terns are also commonly observed migrants at Desert Lake.

Desert Lake WMA also provides important breeding habitat for waterfowl such as mallards, gadwalls, and redheads, with a total of 75 to 100 broods in most years. American avocets, black-necked stilts, snowy plovers, killdeers, Franklin's and California gulls as well as Forster's terns commonly nest at Desert Lake. In addition, great blue heron, black-crowned night heron, white-faced ibis, and snowy egret rookeries may be found among the larger trees around Desert Lake. Grebes such as eared, western, and pied-billed grebes may also be found nesting in the marshy areas along the lake. Breeding season for most species generally occurs from April through mid-August.

3.7.7 Reptiles and Amphibians

Seven species of amphibians potentially occur in the project vicinity, including the tiger salamander, Great Basin spadefoot, Great Plains toad, red-spotted toad, Woodhouse's toad, striped chorus frog, and northern leopard frog (Behler and King 1979, Dalton et al. 1990). All of these species are relatively common across their geographic range and none are classified as sensitive (Utah Natural Heritage Program 1996, Dalton et al. 1990). In general, amphibians are limited to mesic areas (streams, ponds, drainages), occurring most often in riparian, wetland, and irrigated agricultural areas.

A total of nineteen reptile species potentially occur in the Project Area, including ten lizard species and nine snake species. Among the lizards most likely to inhabit the Project Area are desert collared lizards, short-horned lizards, sagebrush lizards, and western whiptails. All of the lizards potentially found in the Project Area are relatively common across their geographic range. Snakes most likely to occur in the Project Area include night snakes, striped whipsnakes, pine snakes, western terrestrial garter snakes, and western rattlesnakes. With the exception of milk snake (see Section 3.8.2), none of the reptiles potentially occurring in the area are considered sensitive (Utah Natural Heritage Program 1996). In southeastern Utah reptiles occur in a variety of ecosystems, but are most common in the sagebrush/grassland, mountain brush, pinyon-juniper, blackbrush, and grassland habitats of desert and submontane elevations (Dalton et al., 1990). A large number of species also occur in riparian areas. Deep, loose soil, open areas, and rocks are important habitat components for reptiles of the region.

3.8 SPECIAL STATUS SPECIES

3.8.1 Regional Overview

Threatened, endangered, and sensitive species are plants and animals that are protected under the Endangered Species Act (50 CFR 17) of 1973, as amended, or other state or federal agency regulations. In general, the protection afforded imperiled species under the ESA includes prohibition from harming or trafficking in endangered species; and, under Section 7 of the Endangered Species Act, the federal government is forbidden to take any action that is likely to jeopardize an endangered or threatened species or to degrade its critical habitat.

Under the Endangered Species Act, an endangered species is one in danger of extinction throughout all or a significant portion of its range: a threatened species is one likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Candidate species (C1) are those being considered for listing as threatened or endangered. Until recently, the U.S. Fish and

Wildlife Service (USFWS) also maintained a list of category 2 (C2) species, those for which listing was considered possibly appropriate, but for which more information on biological vulnerability and threat were needed to support proposed rules. As of February 28, 1996, the USFWS no longer maintains a list of C2 species, but they are considered to be sensitive by BLM personnel and other agencies.

Utah Division of Wildlife Resources draft status categories (UDWR 1996) include endangered, threatened, S1 (species declining in population, distribution and/or habitat), S2 (species occurring in limited areas and/or numbers due to a restricted or specialized habitat), and S1S2 (both declining and of limited occurrence).

Under Section 7 of the Endangered Species Act, federal agencies are required to evaluate the effects of their actions on listed and proposed endangered and threatened species, and to consult with the USFWS if they determine that their actions may affect any species. This EIS, and specifically sections 2.0, 3.8.3 and 4.8, has been developed to serve as the BLM's Biological Assessment for the Price CBM Project, and a separate stand-alone Biological Assessment will not be prepared.

Species of concern and their status, that may be present within the Project Area, are listed in Table 3.8-1. Copies of correspondence with the USFWS are provided in Appendix 3C.

3.8.2 Federal Endangered or Threatened Species

Bald Eagle

The bald eagle is a federally listed threatened species that is known to winter in the Project Area. It is an opportunistic forager during winter, often relying on rabbits, ground squirrels and carrion and typically roosts communally during winter. Twenty-five to 30 bald eagles typically utilize the Project Area during the winter (Bates 1994). The estimated area of essential habitat for wintering bald eagles in the Project Area is shown on Plate 20A. Essential habitat for wintering bald eagles includes communal roost sites and primary foraging areas (Northern States Bald Eagle Recovery Team, 1983). Essential winter roosts in the State of Utah are those occupied by 15 or more eagles for two weeks or longer.

Field surveys for bald eagle roosts were conducted four times by fixed-wing plane and helicopter in February and March 1995 (MDG and Associates 1995c). The initial survey covered the entire Project Area, and subsequent surveys flew drainageways, areas of known eagle use and other areas of potential habitat. An estimated 8 to 12 wintering bald eagles were present in the Project Area during the survey periods, and four winter roost sites were observed. The winter of 1994-95 was generally mild, and the abundance of bald eagles was reduced from typical winters (Bates 1994). Based on past records, one of the roost sites typically has 12-15 bald eagles, and a second site typically has 5-10 bald eagles (Bates 1994). The other two roost sites appear be secondary sites. An adult and a subadult were observed at Bull Point on one occasion during the 1995 surveys, and a single adult was observed at the Miller Creek site on two

occasions. These two sites had not been previously identified as winter roosts.

Black-Footed Ferret

Black-footed ferrets depend on prairie dog colonies as a source of food and shelter. Changes in land use practices and poisoning programs over the last century have substantially reduced prairie dog distribution in the western United States. As a result, all active prairie dog towns, or a complex of towns large enough to support ferrets are considered potential black-footed ferret habitat. Current USFWS criteria for defining potential black-footed ferret habitat consists of any black-tailed prairie dog town or complex of greater than 80 acres in area and any white-tailed prairie dog colony or complex greater than 200 acres in size (USFWS 1989). The Project Area contains 31 white-tailed prairie dog colonies totaling approximately 6,865 acres (MDG and Associates 1995b). These towns are all within 7 kilometers of each other, thereby meeting the criteria as a contiguous complex (Plate 19A).

Black-footed ferret are not known to currently occur in the Project Area, although there have been unconfirmed reports of past sightings. The Utah Natural Heritage Program has records of four historic observations of ferrets within the Project Area. One was found north of Price in 1966 but may have been a domestic ferret; three were reported between Price and Huntington off of Highway 10 in 1984; and two northwest of Wellington in 1984 (Peterson 1995). Surveys were conducted in the winter and summer of 1995 following standard USFWS survey methods and no signs of black-footed ferret were observed (MDG and Associates 1995b).

Colorado River Fish

Four endangered fish species occur in the Colorado River downstream from the Project Area: humpback chub, razorback sucker, Colorado squawfish, and bonytail chub. These fish inhabit large rivers, pools, eddies, and other areas adjacent to the main current flows, and move into main channel areas to feed (Haynes and Muth 1982, Woodling 1985). There are no current or historic records of their occurrence in the Project Area. The closest documented occurrence is 9 squawfish (2 in spawning condition) 37 miles upstream from the confluence of the Green River (Bates 1977), or approximately 15 miles or more downstream from the eastern edge of the Project Area.

Peregrine Falcon

The peregrine falcon is listed as endangered by both the USFWS and the State of Utah. They nest on cliffs, typically associated with riparian habitat, throughout Utah. The Colorado Plateau portion of the population in Utah is currently recovering.

An active peregrine falcon eyrie (nest) was discovered in the summer of 1996 on the western edge of the Project Area, during raptor nest surveys conducted by UDWR and a coal mine operator. Peregrine falcon had not previously been observed breeding in the Project Area (Avocet 1995), although they were known to nest elsewhere in both Carbon and Emery County. Individuals may also occur in the Project Area during migration.

Endangered and Threatened Plants

Six plant species in Emery County are listed as endangered or threatened, including Barneby reed mustard, Jones cycladenia, Last Chance Townsendia, Maguire Daisy, San Rafael cactus, and Wright fishhook cactus. These are species of central or southwestern Emery County (Atwood et al. 1991), and are not known or expected to occur in the northwestern portion of the county where the proposed project is located.

3.8.3 Sensitive Species

Northern Goshawk

The northern goshawk is the largest North American member of the genus *Accipiter* and inhabits coniferous, deciduous, or mixed forests. This species requires large coniferous or deciduous trees in older stands for nesting. Nesting stands typically have a high degree of canopy closure and are often located on northern aspects (Reynolds 1989). Suitable nesting habitat is critical to the reproductive biology of goshawks. Nest areas are frequently reused for years and many goshawks have between two and four alternate nest areas within their home range (Reynolds et al. 1992).

Surveys for northern goshawk were conducted for the EIS in the winter and spring of 1995 (MDG and Associates 1995c). Aerial surveys of suitable habitat were conducted simultaneously with bald eagle aerial surveys, and all stick nests observed were mapped. Based on these surveys, there are no riparian or forest stands within the Project Area satisfying the nesting habitat requirements of the northern goshawk, which according to Reynolds et al. (1992) consist of older aged forest stands that have a high density of large trees, high tree canopy cover, and high basal area. Some marginal habitat with stick nests was identified in the upper reaches of Gordon Creek, but ground verification of stick nests in this area during the breeding season resulted in no observations of northern goshawk. Other riparian corridors associated with perennial streams with mature or overmature cottonwood also represent potential, although marginal, habitat for this species.

Ferruginous Hawk

This is the largest hawk in North America. It inhabits open prairie and desert habitats and is strongly associated with primary prey species including prairie dogs (Plate 19A), ground squirrels, and jack-rabbits. Nests are often placed on the edge between pinyon-juniper and shrub steppe, where there are trees for nesting adjacent to open foraging areas. There are at least four areas of historic nesting within the Project Area, none of which were active in 1994 or 1995 (Parrish 1995). An additional ferruginous hawk nest is located outside the Project Area near Wellington, and produced two young in 1994.

Western Burrowing Owl

The western burrowing owl breeds in prairie, desert, sagebrush, and pinyon-juniper habitats in western North America (Finch 1992). Burrowing owls use the burrows of digging mammals for nesting burrows which they fill with organic debris and animal dung for nesting material (Evans 1982). This species is likely to occur in the Project Area during the spring and summer. They are likely to be uncommon in much of the Project Area, but common in prairie dog towns (Plate 19A). They were not observed during summer searches of the 6,685 acres of white-tailed prairie dog towns in the Project Area, but the surveys were done in September, after the time that burrowing owls

were likely to have migrated.

Loggerhead Shrike

The loggerhead shrike is a perching bird of pasture, savannah and open brushland and is territorial in winter as well as summer (Fraser and Luukkonen 1986). Based on a literature review, discussions with local experts, and evaluation of available habitat, about 17,643 acres of potential nesting habitat for loggerhead shrike occur within the Project Area (MDG and Associates 1995d). Breeding areas typically include open habitats with sparse trees and shrubs; elevated hunting perches; nest sites in large sagebrush, greasewood, pinyon-juniper or the interior of abandoned black-billed magpie nests; foraging areas within open, shortgrass habitats within a short distance of an elevated perch; and elevation below 6,000 feet. Shrike are typically observed in south-central Utah in pinyon-juniper and sagebrush habitats, and the arid salt desert vegetation of the Castle Valley may not provide enough prey base to support breeding shrike.

Potential breeding habitat covers only about 10 percent of the Project Area, and occurs primarily in the northern and central portions where there are edges between pinyon-juniper and sagebrush-grassland vegetation, at 6,000 feet elevation or less (Plate 20A). Shrike have been recorded during breeding bird surveys conducted in the extreme eastern and southern portions of the Project Area. Breeding bird surveys have not been conducted elsewhere in the Project Area. However, juvenile and adult shrike were observed during other unrelated field studies conducted in the Project Area during 1994.

Spotted Bat

The spotted bat is a federally listed candidate species that occurs primarily in the Southwest and extends north into Montana (Watkins 1977). The apparent rarity of spotted bats may be a function of their non-colonial behavior (Toone 1993). Habitats used by spotted bat consist of arid rough desert, ponderosa pine and limestone cliffs. This species is apparently widespread although extremely rare. A recent study of spotted bats was conducted by the Utah Division of Natural Resources in an area that included western Carbon and Emery Counties. The closest occurrences identified in this survey were at Johnson Valley Reservoir dam, the Fish Creek Mine site, and at Snow lake (Toone 1993), and no occurrence was found within or near the Project Area. Another recent study (Toone 1995) involved field surveys at a number of sites in the BLM Price River Resource Area, including sites representing a variety of habitats within the Book Cliffs/Roan Cliffs Plateau and Wasatch Plateau regions. Spotted bats were observed at several sites. Although they were not specifically found in the Project Area, they were found in similar habitats and can be considered likely to occur. Spotted bats roost in crevices in limestone and sandstone cliffs, and forage preferentially over water, wetlands, riparian areas and irrigated meadows within approximately 6 miles of day roosts.

Other Bats

Six species of sensitive bats are known or likely to occur within the Price River Resource Area (Toone 1995). These include big free-tailed bat, fringed myotis, long-eared myotis, long-legged myotis, and small-footed myotis, and Yuma myotis (Toone 1995) Pale Townsend's big eared bat may potentially occur.

Milk Snake

The milk snake is currently classified as an S1 state sensitive species by UDWR; however, UDWR's list of Native Wildlife Species of Special Concern is under review (UDWR 1996). They occur in cold desert, submontane and montane zones, within aspen, sagebrush-grass, mountain brush, pinyon-juniper and salt desert ecosystems (Dalton et al 1990). They are considered rare in the geographic areas present in the Project Area (Wasatch Plateau and San Rafael Desert geographic areas).

Colorado River Fish

Two sensitive Colorado river fish, the roundtail chub and flannelmouth sucker occupy slow moving waters adjacent to areas of faster river waters or pools of streams and large rivers. Young-of-the-year prefer shallow river runs while juveniles concentrate in river eddies and irrigation ditches (Valdez 1982; Wiltzius 1978). Neither of these species are known or expected to occur within the Project Area, but they occur downstream in the lower Price River and in the Green River. A recent study in the Price River between Woodside and the confluence with the Green River (approximately 30-55 miles downstream from the Project Area) captured 76 flannelmouth and no roundtail chub (Masslich and Holden 1995).

Creutzfeldt Catseye (cryptantha)

This herbaceous plant species is very limited geographically, from Fremont Junction to East Carbon, in Emery and Carbon counties, Utah. It grows primarily on the Blue Gate member of the Mancos Shale, often where there is a veneer of sandstone fragments, in openings within pinyon-juniper habitat. There are two known occurrences just west of Price, Utah (Intermountain Ecosystems 1995, Peterson 1995). A survey conducted in August of 1994 covered about 6,500 acres and found no additional occurrences of this species within the Project Area (Intermountain Ecosystems 1995). However, much of the Project Area is potential habitat.

Canyon Sweetvetch

This plant species inhabits shaded intermittent washes and perennial streams in sagebrush, pinyon-juniper, and mountain shrub communities (Intermountain Ecosystems 1995). Several occurrences have been documented near the Project Area in the Book Cliffs and the Wasatch Plateau, including one occurrence near Hiawatha (Intermountain Ecosystems 1995, Peterson 1995). Surveys conducted for this EIS found no occurrences of this species within the Project Area (Intermountain Ecosystems 1995), but it may occur in shaded riparian areas and ephemeral or intermittent washes.

Graham Beardtongue

This federal candidate species is known or expected to occur in Carbon County (USFWS

1996). It is a species of the Uintah Basin in Utah and Colorado (Atwood et al. 1991), which covers part of eastern Carbon County. It is not known or expected to be present in western

Carbon County or the Project Area.

3.9 CULTURAL RESOURCES

Cultural resources are defined as fragile and nonrenewable remains of prehistoric and historic human activity, occupation, or endeavor as reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in human history. Cultural resources comprise the physical remains themselves, the areas where significant human events occurred even if evidence of the event no longer remains, and the environment surrounding the actual resource. BLM-Utah defines a cultural resource site as a discrete locus of human activity that is presumed to be interpretable.

Significant cultural resources are defined as those listed on or eligible for listing on the National Register of Historic Places (NRHP). Significant cultural resources are generally at least 50 years old and meet one or more of the criteria presented in 36 CFR 60.4, which specifies that the quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Prehistoric cultural resources are generally evaluated with respect to criterion (d), which pertains to a site's potential for yielding scientifically valuable information. The measure of the importance of the scientific data is based upon research questions widely recognized as appropriate by the scientific community. Sites most likely to yield these important data are those with intact cultural deposits, where artifacts and features are relatively undisturbed. In addition to retaining contextual integrity, sites with the highest research value are those likely to contain cultural features. Features such as hearths, storage or habitation structures, or living surfaces often yield charcoal for radiocarbon dating, macrobotanical, palynological, and faunal evidence of subsistence practices, and associated datable artifact assemblages. Sites with artifacts diagnostic of a particular temporal period or cultural group are also regarded as having higher research potential than those lacking diagnostic artifacts. Sites attributable to a specific cultural unit can be used to address specific research questions and are regarded as important resources.

Historic sites can potentially meet any of the four criteria for eligibility to the NRHP. Frequently, however, the focus is upon architectural significance or association with events or individuals of historical importance. Although site-specific historical research is often warranted after a site is identified to determine whether it was associated with an

important individual or event, a site's value as an archaeological resource should not be overlooked. When considering a historic site's archaeological value, the condition of structures or burial of cultural deposits are not as important as whether information exists on the site in the form of artifacts or cultural features that can answer questions of particular interest about the past. Sites that can be confidently ascribed to a particular historic theme and subtheme are generally regarded as having more research value than sites that cannot be ascribed to a theme. Significant historic archaeological resources are those that are relatively undisturbed, can be attributed to a specific theme, and retain sufficient artifacts and features to permit further study. Linear cultural resources such as roads, trails, and ditches generally possess little archaeological value, though in some instances they may retain engineering significance or be associated with important historic events. Roads, trails, and railroad grades, however, may have other historic site types associated with them that are important archaeological resources, the proper interpretation of which may depend upon identification of the linear site.

The significance of traditional cultural properties is usually assessed by talking with tribal elders and other knowledgeable individuals and through historical documentation. Some traditional cultural properties may be significant to an entire Native American group, whereas others may be significant to an individual or family.

3.9.1 Regional Overview

The human occupation of central Utah began roughly 12,000 years ago. Archaeological evidence exists of use of the area by Paleoindian (10,000-7500 B.C.), Archaic (7500 B.C. - A.D. 150), Fremont (A.D. 500-1200), Protohistoric Numic (A.D. 1200-1700), and historic Ute (A.D. 1700 to 1880). The first documented Euroamerican foray into the region was the Dominguez-Escalante Expedition of 1776. The area was exploited by fur trappers in the early nineteenth century, with government and Mormon expeditions entering the area in the 1850s. Settlements related to agriculture, ranching, and mining began to be established in the 1860s and increased following the construction of the Denver & Rio Grande Railroad in 1882. Coal mining boomed in the region until the 1920s and remains a major industry in the area today.

3.9.2 Model for Cultural Resources

In order to assess anticipated impacts to significant cultural resources in the Project Area, a Class I inventory (site file search) was conducted at the Antiquities Section, Division of State History, Salt Lake City, and at the BLM, Price River Resource Area Office, Price, Utah. Locations of previously recorded sites were plotted on project maps, and the following site data were compiled: site type, cultural affiliation, and NRHP status. The NRHP for Carbon and Emery counties was checked to identify cultural properties listed to date. The General Land Office Historic Index, on file at the BLM Utah State Office, Salt Lake City, was reviewed to identify the time range and density of homestead entries in the Project Area.

Numerous sample-oriented (i.e., "Class II") and intensive (i.e., "Class III") cultural resource

inventories have been conducted within or adjacent to the boundaries of the Project Area (e.g., Harper et al. 1978; McDonald 1978; Hauck 1979; Reed and Chandler 1984; Black and Metcalf 1986; Billat 1982; Berge and Spencer 1977; Montgomery 1984; Norman and Hauck 1980; Norman et al. 1980; Robinson 1981). Most of the inventories have been for linear projects such as roads, seismic lines, and pipelines, but some block inventories have also been conducted. Cultural resource inventories have been conducted in advance of development of the non-agricultural land managed by the BLM. The Price River corridor, much of which is privately owned land, has received the least intensive inventory coverage. Cultural resource inventory coverage is also poor in the Poison Spring Bench area; north of Miller Creek, particularly in the Pinnacle Bench, Porphyry Bench, and The Cove areas; and in the Upper Gordon Creek area.

Taken as a whole, the Historic Index and cultural resource surveys have provided data on where sites are located, and perhaps just as importantly, have identified locales where sites are less likely to be located. USGS topographic maps, vegetation maps, and soils maps, in concert with the site data, were employed to identify areas of high, medium, and low sensitivity for cultural resources (Plate 21).

Known prehistoric sites are restricted to the slightly higher upland areas of the Project Area, above 6,000 feet in elevation, suggesting that the lower areas were seldom used by prehistoric peoples. It is likely that the slightly higher uplands, which are characterized by piñon-juniper woodland vegetation, had more to offer in terms of diversity of plants and animals, and that limited agriculture may have been practiced there in suitable situations during Formative times. Fremont habitation sites are most abundant on low rises next to stream courses or springs where arable soils are present and water is available. Prehistoric activity areas or resource procurement locales are found on level terrain at slightly higher elevations in piñon-juniper woodlands. Again, a settlement pattern along permanent water is noted.

Although the cultural resource inventory data would appear to suggest that historic sites are distributed broadly and sparsely throughout the entire Project Area, the distribution of recorded historic archaeological sites does not appear to be an accurate reflection of historic activity in the Project Area. The General Land Office Historical Index, on file at the Utah State Office of the BLM, suggests a much more patterned distribution of historic sites. Data on the distribution of homestead entries were used in conjunction with known historic site data to define sensitivity zones for historic sites.

The high sensitivity areas, where cultural resources are expected to be most abundant, total 86,483 acres, or roughly 46 percent of the Project Area. Of this total, 24,496 acres are BLM, 10,200 acres are UDWR, 10,497 acres are State, and 41,290 acres are privately owned. Areas of high sensitivity for cultural resources include the following:

I. In areas above 6,000 feet elevation, a one-mile-wide corridor along permanent streams (i.e., the original location of Cedar Creek, Miller Creek,

the North and South Forks of Gordon Creek, Trail Creek, Bob Wright Creek, and Mud Water Creek and its permanent tributaries). Expected significant site types in this zone include prehistoric habitation sites, rock art sites, and campsites.

II. A 660-foot radius buffer zone around springs. Expected significant site types in this zone include prehistoric habitation sites, rock art sites, and campsites.

III. Areas associated with historic coal mining (i.e., the upper Gordon Creek drainage, the upper Miller Creek drainage in the vicinity of Hiawatha, the Wattis Siding area). Expected significant site types in this zone include both occupied and abandoned townsites, railroads and railroad facilities, and active and abandoned coal mines.

IV. Areas of intensive agricultural settlement in historic times (i.e., the irrigable lands along the Price River, the Gordon Creek valley, and the Elmo and Desert Lake vicinity in the southeastern portion of the Project Area). Expected significant site types include towns, active and abandoned farms and ranches, and ancillary facilities.

The medium sensitivity areas, where moderate numbers of cultural resources are expected, total 82,052 acres, or roughly 44 percent of the Project Area. Of this total, 49,834 acres are BLM, 901 acres are UDWR, 15,332 acres are State, and 15,984 acres are privately owned. Areas of medium sensitivity for cultural resources include the following:

I. The uplands in the western portion of the Project Area. The level terrain above 6,000 feet elevation is characterized by piñon-juniper woodlands. Expected significant site types include prehistoric campsites and, occasionally, prehistoric habitation sites.

II. Marginal agricultural lands that are expected to contain abandoned farms and ranches that were occupied for short periods in the 1910s and 1920s, occasional long-term or currently occupied farms and ranches, and camps related to sheep and cattle grazing.

III. Areas where low-production coal mining took place. Expected site types include sections of coal mining railroad grades, minor railroad facilities, and small coal mines and associated facilities.

The low sensitivity areas total 19,708 acres, or roughly 11 percent of the Project Area. Of this total, 8,055 acres are BLM, 9,037 acres are State, and 2,346 acres are privately owned. No UDWR land is in the low sensitivity areas. Low sensitivity areas are the salt desert lands along State Road 10 in the center of the Project Area and steep slopes at the southwest and northwest corners of the Project Area. No prehistoric cultural resources are expected within the low density zone. Historic site types expected in the low sensitivity zone include small campsites or artifact scatters and occasional evidence of briefly occupied farms and ranches. Few sites in the low sensitivity zone are expected to be recommended as NRHP eligible.

3.9.3 Known Cultural Resources

As of the end of 1996, cultural resource inventory projects have been conducted in conjunction with the RGC drilling program in the Project Area. Most of these studies have taken place on state and private lands; small amounts of BLM land have been involved. Three compressor station sites, 149 well locations, two core holes, one building location, one overburden storage site, eight evaporation ponds, a 46 kV electrical transmission line, two electrical substations, and associated access roads and utility corridors were intensively examined for cultural resources, for a total of approximately 1,420 acres inventoried at the Class III level (Allison 1996; Allison and Sulz 1996; Hughes 1996; Newberry 1995, 1996; Nielson 1993a, 1993b, 1993c, 1996a, 1996b, 1996c, 1996d, 1996e; Nielson and Hughes 1996; Nielson and Sulz 1993, 1994a, 1994b, 1996; Norman, Hughes, and Sulz 1994; Norman, Nielson, and Sulz 1995; Senulis 1996). Two prehistoric artifact scatters, two prehistoric sites with slab-lined cists, one historic site containing a sparse scatter of prehistoric lithics, 14 historic sites, and 47 isolated historic and prehistoric artifacts were recorded by these projects. The historic Carbon Canal, a historic sheep camp, and a prehistoric slab-lined cist were considered significant cultural resources, and a prehistoric camp site with a slab-lined cist was judged to be potentially significant; in all four instances, the significant sites were avoided by the development activities.

Seventy-five prehistoric site components have been recorded in the entire Project Area. A large number of these (32 sites, or 43 percent) are lithic scatters for which cultural affiliation could not be determined. No sites with Paleoindian components have been recorded in the Project Area, but six sites with Paleoindian projectile points have been recorded at the southern end of Castle Valley (Black and Metcalf 1986:143). Although Archaic sites are common in central Utah, only one lithic scatter with a diagnostic Archaic projectile point has been recorded in the Project Area.

Sites affiliated with the Fremont culture are common in the Project Area, numbering 25 (33 percent). Site types include rock art panels (6), artifact scatters (6), habitation sites containing masonry rooms (12), and a campsite (1). A Fremont village and numerous rock art panels have been recorded along Gordon Creek. Three Fremont village sites have been excavated near the southwestern boundary of the Project Area (Madsen 1975).

Late Prehistoric sites that can probably be attributed to the Numic/Ute are not numerous in the Project Area. These consist of one rock art site and two campsites. The rock art site was recorded as a dual component Fremont/Late Prehistoric site.

No prehistoric sites in the Project Area have been formally listed on the NRHP, but 30 prehistoric sites (40 percent of all recorded prehistoric sites) have been recommended by field recorders as eligible for listing on the NRHP.

Another category of cultural resources that must be considered are traditional cultural properties that have been identified by contemporary Native American groups as having religious or other traditional significance.

No traditional cultural properties have yet been identified in the Project Area. Although the Project Area is not in a claim determined by the Indian Claims Commission, Numic-speaking groups and Puebloan groups have a historic interest in the area.

Sixty historic archaeological sites have been recorded in the Project Area; numerous other historic sites are known to exist but have not yet been formally recorded. Recorded sites include the coal mining townsite of Mohrland, six residential sites, 12 other sites that contain historic structural remains, five sites associated with coal mining, four sites related to railroads, eight historic camps, one corral, 17 artifact scatters, two bridges, one ditch, and three canals or canal complexes. Eighteen of these historic sites have been recommended by field recorders as eligible for listing on the NRHP. In addition, ten buildings in the town of Price have been placed on the NRHP: the Oliver John Harmon House, the Greek Orthodox Church of Assumption, the James W. Loofbourow House, the Parker & Weeter Block/Mahleres-Siampenos Building, the Moyneir House, Notre Dame de Lourdes Catholic Church, Price Municipal Building, Price Tavern/Braffet Block, Star/Carbon Theater, and the Price Main Post Office. In

Spring Glen, the Martin Millarich Hall and Topolovec Farmstead are listed properties.

3.10 LAND USE

3.10.1 Regional Overview

The Project Area lies within southern Carbon County and northern Emery County, Utah. Public lands within the Project Area are administered by the USDI, BLM, the UDWR, and SITLA. Land ownership and jurisdictional boundaries are shown on Plate 1. Private lands are under the jurisdictions of Carbon and Emery counties and the incorporated cities of Price and Wellington.

3.10.2 Land Jurisdictions

Existing land uses within the Project Area consist of rural communities, mineral exploration and production facilities, transportation and utility corridors, agriculture, grazing, wildlife habitat and dispersed recreation. Plate 22 shows this distribution of land uses in the Project Area. This map shows existing land use, and is not a zoning map of Carbon or Emery Counties. Wildlife habitats, grazing, and recreation are discussed in Sections 3.7, 3.11 and 3.12, respectively.

The distribution of federal, state and private lands forms a mosaic pattern over the Project Area. The BLM lands are administered by the Moab District and Price River Resource Area. BLM lands are concentrated in large blocks in the western extent of the Project Area. The U.S. Department of Agriculture, Forest Service manages the Manti-LaSal National Forest, located west of the Project Area. State lands managed by SITLA are similarly dispersed throughout the Project Area, with larger blocks located to the northeast and southwest of Price. Lands under the jurisdiction of the State of Utah, Division of Wildlife are part of the Gordon Creek State Wildlife Management Area (Plate 22).

3.10.3 Existing Land Uses

The communities in Carbon and Emery counties have historically developed in response to mineral and energy developments. Most of the towns within the Project Area are primarily situated along Highway 6 and include Spring Glen, Carbonville, Price, and Wellington. Among these, the City of Price is the largest community and is the county seat of Carbon County. Located approximately 9 miles west of Highway 6 on State Route 122 is Hiawatha, a historical mining town which is now largely abandoned. The town boundaries of Elmo, located in Emery County is partially within the southeast corner of the EIS Project Area.

A variety of mineral and extractive uses are within or near the Project Area. Major facilities and operations are Co-op Coal Mining and Andalex Resources. A number of extractive-related industries occur as well, including coal transportation services, rock products, sand and gravel operations, and abandoned coal mines. Other large-scale mineral/energy developments within the region are the Castlegate Mines No. 1 and 2 and the Castlegate Project Area. These operations are all located north of the Project Area in Carbon County. In Emery County, the Hunters Plant and Huntington Plant and mine lie to the south of the Project Area.

The existing CBM operations are located in the central part of the Project Area, and consist of 98 wells, located on private and state lands. Ancillary facilities associated with the existing RGC operations consist of a network of roads and pipelines, a compressor facility, an injection well, and power distribution lines.

Agricultural lands within the Project Area consist of both irrigated cropland and grazing lands. Irrigated crops are found primarily in the eastern part of the Project Area, along the Price River Valley. Principal crops include grains, hay, silage, vegetables and melons. Grazing is a primary use on much of the public lands, which are principally used for domestic livestock summer pasture. Livestock and poultry products are cattle/calves, dairy products, hogs and pigs.

3.10.4 Land Use Plans

The management of federal public lands and resources within the Project Area is directed and guided by the BLM's Price River Resource Area Management Framework Plan for the years 1983-84 (USDI, BLM 1984a) and the San Rafael Resource Management Plan (1988c). Other management direction is provided in the Price River Resource Area MFP Supplement on the Designation of Hydrocarbon Lease Categories Outside Special Tar Sands Areas (USDI, BLM 1984a), and the subsequent Environmental Assessment Supplement on Cumulative Impacts on Oil and Gas Categories (USDI, BLM 1988a). The US Forest Service manages lands on the Manti-LaSal National Forest in accordance with the Land and Resource Management Plan, Manti-LaSal National Forest (USDA, FS 1985). National Forest lands are west of the Project Area.

The Federal Onshore Oil and Gas Leasing Reform Act of 1987 (Public Law No. 100-203) requires that BLM regulate all surface disturbing activities on surface or mineral estate owned by the United States of America and

managed under the jurisdiction of BLM (30 U.S.C. 226(g)). BLM is responsible for ensuring that development activities are conducted in a manner that minimizes conflicts with other uses and damage to surface resources. This review is accomplished through the APD process. An APD includes a drilling plan, evidence of bond coverage, and other information deemed appropriate by BLM for evaluating the proposed well.

The management of State of Utah lands primarily is the responsibility of the SITLA. The state does not have a general management plan for lands in the Project Area. The SITLA makes decisions regarding the use of state lands directed toward obtaining the greatest possible monetary return for the trust consistent with sound management practices; managing trust lands for their highest and best use; and perpetuating the renewable natural resources on trust lands using conservation practices. For wells drilled on Utah mineral estate, applicant(s) would seek approval from the UDOGM, and approval from the SITLA for access onto state-owned surface lands. To develop on private mineral estate, applicant(s) would submit an APD to the UDOGM, and enter into agreements with the individual landowners for access to the sites. The Project Area includes "split-estate" lands (i.e., surface ownership and mineral estate ownership are split between two different owners or land managing agencies.) Other state lands in the Project Area are part of the Gordon Creek Wildlife Management Area. The Land Management Plan for the Gordon Creek Wildlife Management Area sets directive for this reserve. The overall purpose of the plan is to manage for the benefit of high interest species (in particular, mule deer and elk) that are associated with ecosystems existing within the 22,960 acres of the management area. More information on this area is provided in Section 3.10.5.

Land management decisions on private land in Carbon and Emery Counties are guided by adopted county land use plans, a development code, and zoning ordinances and regulations. Carbon County recently approved a new Comprehensive Plan in January, 1997 (Bear West Company 1996). This document serves as a guide for planning efforts in the County, and addresses policies, objectives, and strategies on many issues important to county managers and residents. The six major components of the plan include issues related to economic development, human services and education, infrastructure and resources, private land uses, public lands and resources, and recreation and tourism. It should be noted that, as an appendix to the new Carbon County Comprehensive Plan, a Carbon County Trails Plan has been completed and adopted. This plan identifies recreational resources, current outdoor recreation activities and perceived issues and needs of the County. A number of the trails identified in the plan are within the Project Area including the Kenilworth/Price Loop, Consumers Wash Road, and Pinnacle Bench/Creek Roads. Recreational opportunities are discussed in Section 3.12.

Emery County has also recently drafted a new General Plan (Emery County 1996). The plan establishes guidelines for all planning efforts within the County and also serves as an avenue for county residents to identify the issues, concerns and values which should be addressed in the plan. Value/Goal statements identify some of the major issues and concerns held by residents in the County. Items identified as major issues/concerns include maintaining Emery County's rural character, public lands, human and community services, transportation, cultural, water, economic development, and

recreation and tourism issues.

Regarding County zoning, classifications that apply to Carbon County lands within the Project Area include:

I. Residential Agricultural (RA-20)
II. Rural Residential (RR-1, RR-2.5, and RR-5)
III. Residential (R-1-20K, R-1-8K, R-2-8K and R-4-8K)
IV. Light Industrial (I-1)
V. Mining and Grazing (M&G1)
VI. Mobile Home Residential (MR-1-20K)
VII. Retail Commercial (C-1)
VIII. Wholesale Commercial (C-2)
IX. General Industrial (I-2)
X. Critical Environmental (CE-1 and CE-2)

Within Emery County, zoning boundaries for the Project Area includes (Draft Zoning Map, Nov. 1996):

I. Agriculture (A-1)
II. Mining and Grazing (M&G1)
III. City Boundary

In Carbon County most of the proposed CBM development would occur within the Mining and Grazing zone (M&G1). Gas wells within this zoning classification are a permitted, unconditional use and no county permits are required specifically for the drilling and operation of CBM wells. Wells in the M&G1 zones fall under UDOGM management and regulations. Other ancillary permits, such as building permits or a permit for an electrical hook-up may be required during the construction phase of the development. In areas zoned as residential, the county requires a conditional use permit. RGC must submit site plans to the County who then reviews the plan and makes a decision on issuing the permit. This process involves a public hearing where members of the public can voice issues and concerns. In Critical Environmental zones (CE-1), RGC must also apply for a conditional use permit and a zoning change. The CE-1 zone includes areas above 7,000 feet. Oil and Gas activities are not allowed in C-1 zones, and for RGC to drill in these areas there must be a zoning change to CE-2. CE-2 are basically CE-1 areas where there has been a zoning change to allow activities that are not typically allowed in CE-1 zones. The process for RGC to be issued a conditional use permit is generally the same as in residential areas. RGC submits a site plan and the County reviews the plan, holds a public hearing on the matter and makes a decision on the permit and zoning change.

In Emery County, oil and gas wells are a permitted activity in all land use zones directly affected by the proposed project. However, each well, regardless of which zone it is located in, requires a conditional use permit. RGC must submit an overall site plan of the development to the County. The plan is reviewed by the County and a decision is made to either approve, approve with modifications, or disapprove the proposed development plans. As in Carbon County, the Emery County review process involves a public hearing where the public can voice their concerns. An application for Permit to Drill (APD) must also be submitted for each individual well. The Planning and Zoning Department may approve the APD administratively or, if there are concerns

regarding a particular well, the application may be sent through the Planning Commission for further review.

3.10.5 Gordon Creek Wildlife Management Area

This area is located in and adjacent to the northwest portion of the Project Area (Plate 22, Land Use). It encompasses 22,960 acres, of which 21,000 are controlled (surface ownership or lease) by Utah Division of Wildlife Resources and BLM, and 1,690 acres are in private ownership (UDWR 1993, 1994b). About half of the area is either federal surface (6,900 acres) or split estate with federal mineral ownership (5,800 acres). About 1/3 of the land owned by or leased by UDWR has federal mineral ownership.

The Gordon Creek Wildlife Management Area provides wintering habitat for over 2,000 elk and thousands of mule deer. Elk that use Gordon Creek come from the Scofield, Beaver Creek, Huntington Canyon, and Gentry Mountain areas, and as far away as Indianola and Fairview. Land purchases by UDWR began in 1960 and continued until 1982. UDWR has also purchased water rights on the North Fork of Gordon Creek, Bob Wright Creek, and other streams.

Most of Gordon Creek Wildlife Management Area is rangeland, but there are three historic cultivated fields on UDWR lands, totaling nearly 600 acres. Irrigation and ditch maintenance has been sporadic since 1980, and forage productivity and quality has greatly decreased. Habitat improvements have included a 2,000 acre chained/reseeded area, spring cattle grazing to reduce competition to browse from grasses on the eastern benches, placement of road-killed deer for bald eagles, reclamation of roads and trails, installation of water catchment and troughs on BLM land to encourage wider dispersal of animals, and reseeding of portions of the historic cultivated fields.

UDWR management goals are to manage habitats for optimum numbers and diversity of wildlife species, with special emphasis on deer, elk and moose, and to allow regulated public access for consumptive and nonconsumptive uses that do not unduly impact habitat or wildlife during crucial periods. BLM lands within the Gordon Creek Wildlife Management Area are also managed for wildlife in coordination with UDWR, and all forage rights on federal lands within the area have been assigned to wildlife since 1965. UDWR has recently invested $219,000 for habitat improvement from mid-1995 through 1997. BLM invested $660,721 from 1970 to 1992 (in 1996 dollars) for water catchments and vegetation treatment projects.

3.10.6 Planned Developments

In addition to the Castlegate CBM Project and the Helper CBM Project, proposed developments within the Project Area include the Hiawatha Co-generation Plant, located near the Carbon/Emery county border near Hiawatha; and the Covol Project, near Wellington. The Hiawatha Co-generation Plant would generate 105MW of power. The Covol Project would utilize waste coal on land purchased from Nevada Power near Wellington to produce coal briquettes. Other smaller proposed developments include seven approved subdivisions in and around Price, and a sawmill near Wellington. No proposed projects were identified for Emery County.

3.10.7 Transportation

All roads that serve the proposed CBM development area and the communities of Price, Wellington, Helper, Huntington, and Castle Dale were considered in this EIS. This transportation network would be used by project workers commuting to the CBM development area from those communities, as well as by trucks hauling various equipment and supplies to the development area. Plate 22 provides a map of roads serving the Project Area.

Major Highways. Federal and state highways provide the main transportation access to the Project Area. The major transportation network in the Project Area consists of three highways: U.S. Highway 6, State Route 10, and State Route 122. Descriptions of each highway are presented below. These highways are maintained by the Utah Department of Transportation. Historic and current traffic counts for each of these highways are provided in Table 3.10-1.

U.S. Highway 6 is an important north-south highway that connects the Project Area with Interstate 15 and the Wasatch Front to the northwest and Interstate 70 to the southeast. Within the Project Area, Highway 6 is a paved divided four-lane highway serving the communities of Helper, Price, and Wellington. Despite its regional significance, traffic volumes along this highway are modest, relative to its capacity, averaging roughly 9,500 vehicles per day on the west side of Price in 1994.

State Route 10 also runs north-south and provides the primary means of access to the central and southern portions of the proposed CBM development area. This two-lane paved highway extends from Price and the CBM development area south to the Project Area communities in Emery County and Interstate 70 to the southwest. In general, traffic volumes along this highway are low due to the sparse population of the area it serves. In 1994, average daily traffic on this highway was approximately 5,055 vehicles per day in the Emery County portion of the Project Area.

State Route 122 runs east-west from SR 10 to Hiawatha and provides access to the south-central portion of the proposed CBM development area near the Carbon-Emery County line. Traffic volumes along this two-lane paved highway are also low due to the sparse population of the area it serves. In 1994, average daily traffic on this highway was approximately 1,370 vehicles per day.

Local Roads. Local roads within the Project Area are extensive and comprise a mix of county roads, City of Price roads, subdivision roads, BLM roads, and roads recently constructed by RGC for development of CBM wells and pipelines. In general, maintenance of local roads has been the responsibility of the entity that owns them, although RGC has done a considerable amount of maintenance work on the county roads it has used to date.

The Carbon County Roads Special Service District was contacted regarding traffic volumes on local roads prior to development of CBM wells in the Project Area. However, traffic counts were unavailable. In general,

traffic volumes on local roads that serve the proposed CBM development area are low due to the fact that the area is very sparsely inhabited. Traffic on these local roads is generally associated with maintenance of existing CBM wells, ranching activities, and recreation. Although local roads that serve inhabited areas are plowed in the winter, wet weather can render unpaved roads virtually impassable for short periods of time.

Other Transportation Systems. Rail service in the Project Area is provided by the Southern Pacific Railroad, which maintains a track that runs from the north end of the Project Area through Helper, Price and Wellington and continues east. In addition, the Utah Railway operates a spur in the western portion of the Project Area which serves the coal mining industry. This spur runs from Helper to Wattis and Hiawatha. In addition, passenger rail service is available to Helper on Amtrak.

Air service in the Project Area is available at the Carbon County Airport, east of Price, and the smaller Huntington Airport in Emery County. These airports primarily serve freight traffic and private aviation. The only passenger service available to the public is through a charter service at the Carbon County Airport.

3.11 LIVESTOCK MANAGEMENT

3.11.1 Regional Overview

Livestock grazing is one of the primary agricultural land uses within the Project Area. The BLM manages 28 grazing allotments which are either completely or partially within the Project Area. These allotments are shown in Plate 23. Table 3.11-1 provides information on the grazing allotments, including total acres of the allotment, AUMs (animal unit months), acres required to produce an AUM in each allotment, livestock type, period of use, BLM management category, and ecological range condition.

Grazing capacities are indicated by AUMs. An AUM represents the number of pounds of forage necessary to sustain one cow or its equivalent for a period of one month. Equivalent animal units for one AUM in the Project Area are 1 cow, 5 sheep, 8.9 mule deer, 2 elk, or 9 antelope. The number of acres required to produce an AUM can vary greatly between the different allotments depending on the available plant production within a given vegetation type. Vegetation types within the Project Area vary from a predominately pinyon-juniper and sagebrush-grass type in the western portion to a mostly salt desert type in the eastern and southeastern part of the Project Area. As shown in Table 3.11-1, the acres necessary to produce one AUM varies greatly between the allotments, with acres per AUM on public lands ranging between 134 acres in the Peterson allotment down to six acres in the Trail Canyon allotment. Private and state lands are estimated to have similar carrying capacity as nearby public lands.

Cattle and sheep are the primary livestock type grazed in the allotments. Time of use varies, with several of the allotments being used in the spring and early summer, and

others being used in the fall or during the winter months. The ecological condition of the range is expressed as seral stage in relation to the range site potential. Potential Natural Community (PNC), and late, mid and early seral are the classifications used, which generally correspond to the Natural Resources Conservation Service ratings of excellent, good, fair and poor, respectively. A little over half (about 53 percent) of the public land acres within the grazing allotments is rated as being in the mid-seral (fair) condition.

The BLM classifies the grazing allotments into three different management categories depending on such factors as range condition, resource use conflicts, opportunity for positive economic return, and whether or not the present management of the allotment appears to be satisfactory or unsatisfactory. This management classification was established to establish priorities for distributing available funds and personnel in a manner that will achieve cost-effective improvement of rangeland condition and production. The three management categories are Maintain, Improve and Custodial. Maintain category criteria include a range condition that is satisfactory; production level near their potential; no serious resource use conflicts; and management that appears to be satisfactory. Improve category criteria include a range condition that is unsatisfactory; low to moderate production levels; serious resource use conflicts; opportunity for positive economic return; and management that appears to be unsatisfactory. The custodial category criteria include a range condition that is not a factor; production levels near their potential; limited resource use conflicts; little opportunity for positive economic return; and a present management that appears to be satisfactory.

3.11.2 Carrying Capacity, Livestock Management and Facilities

As described in Section 3.11.1, carrying capacity is indicated by AUMs, which are shown for each allotment in Table 3.11-1. The number of AUMs an allotment can produce is related to several factors including soil productivity, vegetation type and quality (for forage value), ecological range condition, and availability of water. Any reduction in the amount or quality of these factors can have a negative effect on the carrying capacity of the allotment.

Livestock operators use the existing road network to move cattle to the allotments and to access the allotment to check on their livestock, fix fences, inspect water tanks, distribute salt and other maintenance activities. Any restrictions in the ability of livestock operators to access the allotments would impact their ability to perform the necessary livestock management activities.

The grazing allotments contain various range improvements which are used to control animal movement and to provide water for livestock. Improvements include fences, cattleguards, corrals, developed springs and wells, detention dams, reservoirs, and water pipelines. In some

areas pinyon-juniper has been chained to encourage herbaceous forage plants. Disruption of these range improvements could impact the control of livestock on the established grazing allotments.

3.12 RECREATION

3.12.1 Regional Overview

Recreational opportunities within the Project Area encompass a range of dispersed uses such as hunting, fishing, hiking, jogging, mountain biking, and wildlife viewing on public federal and state lands that are in close proximity to the local communities. Developed recreational areas provide opportunities for golfing, shooting and target practice and picnicking.

Recreational uses of public lands are typically documented by federal agencies through the Recreation Opportunity Spectrum (ROS) inventories. Information on recreational uses within and adjacent to the Project Area is based upon the USFS ROS inventories and supplemental data provided by the counties, BLM, and USFS.

Dispersed recreational activities occurring on public lands include hunting, mountain biking, off-road vehicle activities, hiking, horseback riding and wildlife viewing. The proximity and accessibility of public lands to local communities enhances the types of activities that occur within the Project Area. Public lands of greatest local concern to residents include (1) lands east and north of the Project Area (located between Price and Kenilworth) which are used extensively by local residents for biking, hiking and jogging; (2) lands west of Price, where hunting and wildlife viewing activities are common in the winter and horseback riding and four-wheeling occur during other seasons; and (3) portions of the Manti-LaSal National Forest, located adjacent and west of the Project Area that are used for hunting, hiking, and mountain biking. National Forest lands are also used during the summer for family reunions and picnics. National Forest lands west of the Project Area are classified as "semi-primitive motorized" and "roaded natural appearing" in the ROS inventory. Scenic drives are also afforded by several state and federal scenic byways, including State Routes 31 and the Nine Mile Canyon Road, a BLM scenic byway. Nine Mile Canyon Road is outside the Project Area while State Route 31 cuts across the southwestern edge of the Project Area.

3.12.2 Recreational Opportunities

Dispersed recreational uses occur throughout the public lands that are administered by the BLM, USFS, and State of Utah. Areas of more concentrated use include the area between Price and Kenilworth which is currently used for mountain biking and annual mountain bike races, and areas used for wildlife viewing and scenic touring. In recent years, there has been increased interest in developing the area's mountain biking potential as a tourism attraction. As part of the comprehensive planning efforts taking place in Carbon County, the county is conducting a regional bike trails study in coordination with BLM and the USFS. Presently, a number of BLM trails are used regularly by locals. Several bike races are also sponsored annually that draw bikers from a larger region. These biking events include a National Off-Road Bicycle Association (NORBA) bike race, known locally as the Butch Cassidy Blow Out Mountain Bike Race. This race takes place northeast of Price, partially within the Project Area. Within the Manti-LaSal National Forest, biking trails closest to the Project Area consist of portions of the Castle Valley Ridge Trail System, located west of the Project Area. Areas of known dispersed recreational activity were used as the sensitivity units for this issue. Several trails, including the Consumers Road/Pinnacle Peak Road loop, the Kenilworth loop, the road to Wattis and Hiawatha, and the airport road northeast of Price are mentioned in recreational guides, including Castle Country by Bicycle Vacation Guides and the Mountain Biker's Guide to Utah by Gregg Bromka.

Carbon County recently approved a county trails plan (Keleher 1995) which identifies trail corridors within Carbon County available for public recreation use. Most of the planned trails within the Price CBM Project Area are existing roads and trails that would become a designated system of trails through trail development and maintenance, standardized trail signing, trailheads and other facilities. Plate 22 (Land Use map in Section 3.10) shows the location of the planned county trail corridors in the vicinity of the Project Area. The major planned trails include the Wood Hill-Kenilworth loop, the Helper to Kenilworth link, the Price River Parkway System, the Pinnacle Peak/Gordon Creek/Consumers Road Loop, and a loop trail in the North Spring Canyon/Horse Bench area, off the main road to Wattis. Trails would provide for different types of use including roadways for 2-wheel drive/low clearance vehicles, roadways that would likely require 4-wheel drive/high clearance vehicles, trails for motorized/off-highway vehicles (OHV), trails for non-motorized travel and trails for non-mechanized travel. As mentioned above, the Wood-Hill-Kenilworth loop is currently a very popular trail system, especially for mountain biking. The Pinnacle Peak/ Consumers Wash loop is also a popular road to view wildlife and to access hunting areas and hiking trails on the Manti La-Sal National Forest west of Price. Current users tend to be local residents, and the availability of close by recreational opportunities is an important factor in the quality of life of local residents. OHVs are a popular form of recreation, with current registrations available from the Department of

Motor Vehicles showing approximately 1,095 ATVs and 337 snowmobiles registered in Carbon County.

Developed recreational areas similarly serve as resource sensitivity units for recreation (see Plate 22). Developed recreational sites within or near the Project Area include community parks, the Four-Mile, Pinnacle Peak and Black Powder Shooting Ranges, the Carbon County Country Club and Golf Course, and the Carbon County Fairgrounds.

Hunting for deer, elk, mountain lion, and small game is a popular activity within the study area. The UDWR estimates the amount of hunting activity occurring within the various wildlife management units across the state. Management units vary by species. The Project Area is within the North Manti Management Unit for deer, the Manti Management Unit for elk, and the East Manti Management Unit for mountain lion. Between 1990 and 1994 estimates on hunter days for deer ranged from 5,000 to 23,000. The herd has been declining in recent years. Hunter days for elk ranged between 19,500 and 23,800 from 1990 to 1994. Recently there were 274 hunter and pursuit days for mountain lion within this management unit. Hunter use data are not available for small game.

The UDWR holds an annual event called Bald Eagle Day, held on the first Saturday in February. Located within the North Fork of Gordon Creek drainage, the event has been attended by approximately 500 people in the last several years. The event is sponsored by UDWR to provide an enjoyable watchable wildlife activity and to increase awareness of watchable wildlife opportunities in the area.

3.13 VISUAL RESOURCES

3.13.1 Regional Overview

Landscape Characteristics

The visual characteristics of the Project Area are created by the influences of landform, vegetation, and water on the line, form, color and texture of the landscape. The Project Area consists of the western-most section of the Colorado Plateau physiographic province, and lies adjacent and east/south of the structural limits of the Wasatch Plateau. The eastern boundary of the Wasatch Plateau is formed by an abrupt wall of barren cliffs and steep slopes, broken only by the mouths of large canyons. To the north and east of the Project Area lies the Roan Cliffs and Book Cliffs. The landscape character of the Project Area is influenced by these adjacent cliffs and the Wasatch Plateau escarpments, which are viewed as background features from most roadways and towns within the Project Area. Overall, the surrounding cliffs and escarpments form a dramatic series of sandstone escarpments that reach 8,500 to 9,000 feet amsl and support little vegetation, thus exposing the multi-colored layers of sandstone.

Within the Project Area elevations range from 5,400 to 7,800 feet amsl and landforms consist of a series of table tops, benches, and drainages, intermittent prominent peaks, and pinnacles, and broad river valleys. Topographically, the landscape is mostly composed of gently rolling hills and benches that surround the broad Price River and Castle valleys. South of the Book Cliffs are a series of northeast-to-southwest trending benches and drainages, including Porphyry Bench, Pinnacle Bench and Horse Bench that are separated by shallow canyons, such as Wildcat, Haley, Pinnacle, and Horse canyons. Benches and

table tops typically form the middleground views from most of the developed valley areas. Elevations range between 6,300 feet and 7,100 feet amsl along the benches and 6,000 feet to 6,100 feet amsl along the bottoms of the canyons. Gordon Creek and Miller Creek trend east-west across this part of the Project Area, providing intermittent water drainage. Vegetation patterns typically form a homogeneous texture of low-profile grey green sagebrush scrub, that provide open visibility conditions. Pinyons and junipers occur at the higher elevations, enhancing the scenic quality of the landscape as well as providing greater visual screening.

The Price River Valley and Castle Project Valley stretch across the central part of the Project Area in a north-south direction. Elevations in the valleys typically range from 5,300 to 5,600 feet amsl. The valleys have largely been developed for rural agricultural, industrial and community uses. The Price River is the most evident natural feature in the valley, along with several prominent hills, including Woodhill that adjoins the city of Price to the north and west.

Scenic Quality

In response to the FLPMA and NEPA, the BLM developed and instituted the Visual Resource Management (VRM) system in the mid 1970s to document and manage visual resources on public lands. The VRM system identifies management classes that permit various levels of landscape alteration. In conjunction with other BLM resource programs, VRM classes are determined based upon the scenic quality of the landscape, viewer sensitivity to the landscape, and the distance that the landscape would be viewed.

Overall, there are four BLM VRM Classes – Class I through IV. The objectives of these classes vary from very limited activity to activity that allows major landscape modifications. Federal lands within the Project Area have been designated by BLM as VRM Classes III and IV. Within the Project Area, approximately 44 percent of the surface lands are under the jurisdiction of the BLM. See Plate 24 (VRM Map). The Class III and IV designations are officially used as a management tool for the BLM-administered lands. As part of the inventory process conducted in the late 1970's, the BLM also evaluated private and state lands. Class III and IV categories were identified by the BLM for private and state lands, based upon similarities in landscape characteristics with nearby federal lands. Based upon recent (June 1996) field reviews, however, many private and public lands have increased in sensitivity over the past 20 years and would qualify as VRM Class II or III today. Landscapes considered to meet Class II or III VRM standards include lands within foreground distance of residential areas,

primary highways, and recreational trails. The objectives of these classes are as follows:

I. Class II - Class II provides for activities that would not be evident in the characteristic landscape. Contrasts are seen, but must not attract attention.

II. Class III - The objective of Class III is to provide for management activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character. In Class III areas, activities may be visually evident, but should not be dominant.

III. Class IV - The objective of Class IV is to provide for management activities that may require major modifications to the existing landscape. The level of change to the landscape can be high and may be visually dominant.

BLM Class III areas are predominantly associated with the natural appearing escarpments and ridgelines that surround the Price River Valley. The scenic quality of these landscapes is considered to be typical of the region. The majority of BLM lands have been categorized as Class IV. Class IV is identified in areas where visibility is reduced due to distance and topography and areas developed for mineral extraction or use. Class II/III landscapes correspond to landscapes within a foreground distance of residential, highways, and recreational uses. Figure 3.13-1 a through d shows representative photographs of landscape quality.

Adjacent and west of the Project Area, the USFS has designated the Visual Quality Objectives (VQO) for the Manti-La Sal National Forest. Lands closest to the Project Area are designated as Partial Retention and Modification VQOs. The majority of lands are classified as Modification, with areas of Partial Retention found along Gentry Mountain. The definitions of these two classes are as follows:

I. Partial Retention VQO - Activities in Partial Retention VQO areas may be evident to the casual observer, but should remain subordinate to the surrounding landscape. Management activities that take place may introduce form, line, color and textures that are infrequently or not found in the characteristic landscape, but should remain visually subordinate to the surrounding landscape.

II. Modification VQO - Activities may visually dominate the surrounding landscape. However, activities should borrow from the naturally established form, line, color and texture so that its visual characteristics are compatible with the natural surroundings.

Visual Sensitivity

Specific areas of public/agency concern for the visual environment were researched through discussions with BLM, the Forest Service, and Carbon County.

Within the Project Area and surrounding vicinity the following areas, termed Key Observation Points (KOPs), were identified as being visually sensitive to change:

I. Communities - including Price, Wellington, Elmo, Spring Glen and Carbonville

II. Dispersed and Rural Residential Areas - occurring primarily in the

eastern half of the Project Area, particularly south and west of Price, west of Elmo and along Gordon Creek Road.

III. Recreation Areas - within the Project Area recreation primarily occurs on public lands and consists of a variety of dispersed activities such as hunting, biking, horseback riding, scenic drives and target shooting. Areas of particular concern to local residents include public lands that provide a natural rural or remote experience within close proximity to Price and other communities. These areas include: Woodhill, lands between Kenilworth and Price, Consumer Wash Road, Gordon Creek Road and the Gordon Creek Wildlife Management Area, Pinnacle Creek Road, Pinnacle Bench, Horse Bench, and Porphyry Bench.

Designated recreation areas of visual concern include trails along Pinnacle Bench and Porphyry Bench that have been recently incorporated into the County's trail system, the Carbon County Fairgrounds, and the Carbon County Country Club.

I. Transportation Corridors - including primary and secondary travel routes. Within the Project Area these include State Highway 6, 10, 155, 122 and 31 and a number of public local roads administered by the County and/or BLM.

Plate 22 shows the location of most of these visually sensitive areas. Reference should be made to the Recreation Section for more information on the location of dispersed recreation activities.

Regional Haze

Regional haze is caused by diminished air quality conditions and causes a degradation of visual quality. This issue is addressed in Section 3.3 of this EIS.

3.14 NOISE

3.14.1 Regional Overview

The Project Area has land uses that vary from sparsely populated rural regions to more density populated, urbanized areas. The National Academy of Sciences (NAS) and EPA have developed expected noise levels based upon population density as shown in Table 3.14-1 and Figure 3.14-1. The population of Carbon and Emery Counties, based on 1990 census data, were 14 and 3 people per square mile, respectively. Based on these density levels, ambient noise in most areas is expected to range from 35 to 40 dB. However, noise levels in the more urbanized areas, such as towns, will be higher. Based on noise monitoring conducted for Amoco's San Juan Coal Degas Project (WCC 1988), L_{dn} levels in Ignacio, Colorado were found to be approximately 62 dBA.

Decibels (dB) are the unit of measure used to represent sound pressure levels, and dBA is the unit of measure used to represent sound pressure levels using the A-Weighted Scale. The A-Weighted decibel measure is used to evaluate ambient noise levels, and common

noise sources. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because

the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. For example, low frequency sound is not perceived as loud as a sound of equal intensity at higher frequency.

Ambient noise levels may also be expressed using the decibel and the L_{dn} scale (National Academy of Sciences 1977). The L_{dn} scale is a logarithmic average of daytime and nighttime decibel levels with a ten dB penalty applied to nighttime levels. This penalty reflects the fact that nighttime noise levels are more irritating to humans than daytime sounds.

In order to better quantify expected maximum existing noise levels in the Project Area, baseline noise monitoring was conducted. Results are presented in Table 3.14-2. Fifteen minute noise levels were monitored downwind and upwind from drilling activity. Downwind levels ranged from 45 dBA at a distance of 3300 feet to 80 dBA at a distance of 150 feet. Upwind levels ranged from 69 dBA at a distance of 350 feet to 77 dBA at a distance of 150 feet. At the closest residence to this activity, daytime levels were 44 dBA and nighttime levels were 28 dBA.

3.15 SOCIOECONOMICS

3.15.1 Regional Overview

The socioeconomic Project Area described in this section includes communities in Carbon and Emery Counties that either lie within the area that is proposed for CBM development or are within reasonable commuting distance. Relevant socioeconomic factors to be discussed include population, housing, employment, community facilities and services, local government fiscal conditions, regional economics, and general quality of life. These socioeconomic factors are most likely to be affected in the communities closest to CBM development or where local facilities and services would be utilized by CBM activities and/or CBM workers.

In Carbon County, the communities of Price, Helper, Wellington, Carbonville, East Carbon, and Sunnyside are included in the socioeconomic Project Area. In Emery County, the socioeconomic Project Area includes the communities of Castle Dale, Orangeville, Huntington, Cleveland, and Elmo.

3.15.2 Socioeconomic Resource Components

3.15.2.1 Population

From 1980 to the present, population levels have fluctuated considerably in both Carbon and Emery Counties. In the early 1980s, the Project Area population grew steadily and peaked in 1983 at 24,100 in Carbon County and 12,700 in Emery County. From 1984 through 1990, the populations of both counties declined significantly. By 1990, Carbon County had 20,200 residents and Emery County had 10,300 residents. This represents population declines of 16 percent and 19 percent respectively in those counties. This population decline was due primarily to high unemployment that was experienced in the Project Area resulting from a decline in the mining and energy industries, as well as a nationwide recession. Although the counties experienced a natural increase in population (births minus deaths), this increase was offset by sizable net outmigration of residents.

Since 1990, however, the populations of both counties have grown modestly. In 1993, Carbon County had 20,700 residents and Emery County had 10,400 residents, representing an increase of roughly 1 to 2 percent since 1990 (Utah Office of Planning and Budget 1994). Long-term estimates project modest population growth in both counties (Knold 1993). Figure 3.15-1 presents a graph of population trends from 1980 to 1994.

3.15.2.2 Local Economy, Employment and Income

The economies of Carbon and Emery counties have experienced considerable swings over the last fifteen years. These counties have been significant producers of coal, and changes in the coal mining industry and energy markets have had a substantial effect on the local economy. In the late 1970s and early 1980s, when the energy market was relatively strong, the economy and population of the Project Area grew steadily in response to availability of skilled jobs offering good pay. During those years, employment in the mining industry reached an all time high, while construction of several coal fired power plants also created numerous construction jobs.

However, starting about 1982, the national recession, combined with the decline of the energy market, increased mechanization of coal mining operations, and closure of other coal mines caused a substantial reduction in employment in the Project Area. In 1983, unemployment in Carbon and Emery Counties soared to 21 percent and 17 percent respectively (Knold 1993). In the years following 1983, unemployment tapered off gradually to about 8 percent in 1990, only to rise again to about 9 percent in 1992 due to continued decline of the mining industry and economic recession experienced nationwide. Figure 3.15-2 illustrates changes in the unemployment rate from 1980 to the present.

Since 1992, Carbon County has shown steady growth in employment opportunities. In the third quarter of 1994, for example, employment increased by 2.8 percent or 200 positions,

increasing total non-farm employment to 7,864 (Utah Department of Employment Security 1994). This recent growth in employment has been experienced in virtually every employment sector except the mining industry. Employment sectors that experienced the strongest growth were the manufacturing, service and retail trade areas. In the fall of 1994, unemployment in Carbon County was roughly 6.0 percent (Utah Department of Employment Security 1994). Within the Project Area, the vast majority of commercial activity is centered in Price and Carbon County, with relatively modest commercial business activity in the towns within Emery County. In recent years, there has been considerable growth in commercial business activity in Price.

In general, Emery County has experienced more modest economic growth in recent years because growth in the service and retail sectors has not occurred as it has in Carbon County. The local government and construction sectors added new jobs in Emery County, while employment declines were experienced in the TCU (transportation, communication, utilities), retail trade, and service sectors. The overall result has been a modest increase of 37 jobs in the last year or a one percent growth in nonfarm employment. In the fall of 1994, unemployment in Emery County was roughly 6.5 percent (Utah Department of Employment Security 1994). Although employment conditions have generally improved in Carbon and Emery Counties over the last ten years, they have experienced higher unemployment rates than the State of Utah and nation almost continuously.

It is important to note that the economies of Carbon and Emery Counties are substantially different in their composition. The most notable difference is the relatively small size of the retail trade and service industries and relatively large size of mining and utility (TCU) sector employment in Emery County. Employment in Emery County is dominated by the mining (26 percent), government (24 percent), and TCU (22 percent) sectors, which provide 75 percent of the employment opportunities in the county. In terms of earnings, roughly 73 percent of income came from the mining and TCU sectors, which reflects the higher wages earned in those sectors. Only 6.6 percent of earnings were derived from the trade and service sectors. By contrast, the largest employment sectors in Price and Carbon County include government (32 percent), trade (27 percent), and services (23 percent), which comprise 82 percent of employment opportunities. Mining comprises approximately 12 percent of employment in Carbon County. The role of Price as the regional trade center is reflected in the fact that 41 percent of total earnings in Price were derived from trade and services. Thus, while employment growth and general economic diversification has occurred at a faster rate in Carbon County, the relatively large percentage of higher-paying mining and utility jobs in Emery County results in higher average monthly earnings ($2,509 in Emery County; $1,688 in Carbon County) (Utah Department of Employment Security 1994).

Relative to Carbon and Emery counties, the economics of the State of Utah and nation as a whole are quite different. In both the state and nation, mining employs just one percent of the work force, versus 12 percent and 26 percent in Carbon and Emery counties. Employment in the TCU sector in the state and nation comprises just 6 percent and 5 percent of total employment, respectively, versus 22 percent in Emery County. This comparison reflects the continued importance of coal mining and electric power generation in the Project Area,

although given the recent growth in the trade and service sectors in Price, the economy of Carbon County is becoming more and more similar to the state and nation as a whole (Utah Office of Planning and Budget 1994). Accordingly, per capita income in Carbon County ($1,688 per month) is similar to the State of Utah ($1,431) and nation ($1,808), while it is considerably higher in Emery County ($2,509).

Tourism is also growing in Carbon and Emery counties, and is considered to be an important part of an increasingly diversifying economy. Attractions that draw tourists to the area include Ninemile Canyon, the San Rafael Swell, and other public lands. Recreational activities enjoyed by visitors to the Project Area include hunting, off-road vehicle use, wildlife observation, Indian rock art viewing, hiking, mountain biking and other activities. In addition, the College of Eastern Utah's Prehistoric Museum and the Cleveland-Lloyd Dinosaur Quarry also attract visitors to Price and the Project Area. Given the generally sparse population and lack of services in the Project Area and surrounding region, Price is the primary source of motel accommodations, restaurant meals, fuel, and other goods and services utilized by tourists visiting these attractions. The abundance of recreational opportunities in and around the Project Area not only attracts tourists, it also contributes to the quality of life for Project Area residents.

Since 1994, RGC has employed local area residents to staff the early stages of its CBM development project. To date, about 89 CBM wells have been completed to the west of Price on State and privately-owned lands. At present, this work employs about 81 local workers, and 83 non-local construction contractors during the May to November construction season. During the winter months, employment drops to about 20 positions to operate and maintain the CBM field. Current local area resident employment is comprised of about 63 construction workers, who generally build project roads and install gas pipelines and utility (water and electrical) lines, and about 18 year round RGC employees, who are responsible for operating and maintaining the completed CBM wells and staffing the Price office. Non-local, or transient construction workers are used because of the need for specialized expertise in drilling and completed the CBM wells. These transient workers reside in motel accommodations while they are working in the local area and do not bring their families with them.

3.15.2.3 Housing

In 1994, housing units in communities in the Carbon County portion of the Project Area comprised a total of roughly 5,025 single family homes, 172 duplexes and fourplexes, 428 apartments, and 1,082 mobile homes. In general, the vacancy rate for housing in Carbon County is roughly 4.0 percent. This low vacancy rate is particularly pronounced in the lower to middle cost rental housing markets. Apartments, duplex/fourplex, and lower cost single family homes are in very short supply at the present time partially due to the strong demand for these types of housing generated by students at the College of Eastern Utah. Construction of a proposed 65 unit dormitory in 1996 may relieve this tight part of the housing market to some extent. In 1995, the cost of renting a home ranged from about $200 to $800, with an average rent of $300. The average sales price for a home in Carbon County was $53,582 (Southeastern Utah Association of Local Governments 1993 and 1995). Table 3.15-1 presents a more detailed breakdown of housing types and vacancies in the various communities in the Project Area.

Numerous sources of temporary housing are also available in the Project Area for potential project contractors. Some examples include motels, mobile home parks, and campgrounds. As mentioned previously, the current non-local construction crew utilizes motel accommodations during the construction season. At present, there are approximately 570 motel rooms available in Price, Wellington, and Helper, with an additional motel under construction. There are also five mobile home parks in the Carbon County portion of the Project Area with an estimated capacity of 300 spaces. Some of these parks can accommodate both mobile homes and RVs.

In communities in the Emery County portion of the Project Area, the total housing supply comprises roughly 1,458 single family homes, 148 duplexes and fourplexes, just 47 apartments, and 441 mobile homes. In general, the vacancy rate for housing in the Emery County portion of the Project Area is slightly higher than Carbon County, at roughly 5 percent. In 1995, the cost of renting a home in Emery County ranged from about $175 to $750, with an average rent of $250. The average sales price for a home was $47,000. Temporary housing is more limited in Emery County than in Carbon County, with a modest number of motel rooms and mobile homes spaces available in the various Project Area communities (Southeastern Utah Association of Local Governments 1993 and 1995).

3.15.2.4 Public Facilities, Services, and Local Government Fiscal Conditions

Public Facilities and Services in Carbon County

The following information was derived from interviews with local government officials, including the Carbon County Planning Department, Carbon County Future, the Carbon County School District, and the Southeastern Utah Association of Governments.

Public Schools. Within the communities in the Project Area portion of Carbon County, there are four elementary schools, three secondary/ junior high schools, and one high school. At present total enrollment in these schools is approximately 4,505 (Utah State Office of Education 1994). In terms of capacity, virtually all of the elementary schools, Helper Jr. High School, and Carbon High School are nearing capacity. Although school enrollment declined

for several years, that trend has reversed, with increases in enrollment observed in many grade levels over the last two years (Bush 1996).

Medical Facilities. The largest medical facility in the Project Area is Castleview Hospital in Price, which is staffed by numerous general and specialized physicians and nurses. The hospital provides 24-hour emergency service, ambulances, and helicopter service. Other medical facilities in Carbon County include a recently opened pediatric clinic, an elderly care clinic, an office of the Southeastern Utah Health Department, and two nursing homes and one residential care center.

Law Enforcement and Fire Protection. Within the Carbon County portion of the Project Area, law enforcement is provided by local police departments in the Cities of Price, Helper, and Wellington. Unincorporated areas are served by the Carbon County Sheriff's Department. In addition, the Utah Highway Patrol also serves Carbon County. Fire protection services are provided by the City of Price, or other local volunteer fire departments in Helper and Wellington.

To date, security in the existing RGC CBM field has been handled internally by RGC. The company has staff that patrols the field at night. According to the Carbon County Sheriff's Office, the CBM field is not patrolled by the Sheriff's office, and law enforcement services have only been requested by RGC in response to occasional vandalism of CBM facilities (Robertson 1996).

Utilities. In Carbon County, electricity is provided by Utah Power and Light. Natural gas is provided by Mountain Fuel. Both of these utility services are modern and have adequate capacity for future growth.

Water Supply and Wastewater Treatment. Water is provided to the various communities in Carbon County by the PRWID and local water districts. The PRWID presently provides all potable water to the City of Wellington, and communities in unincorporated Carbon County, such as Spring Glen and Carbonville. The Cities of Price and Helper have their own water supplies. On occasion, the PRWID provides supplemental water to Price and Helper. Although the PRWID's potable water plant operates at capacity during hot summer weather, a proposed expansion of the plant from 4 million gallons per day (Mgd) to 6 Mgd will be completed around August of 1997 (Snook 1996). With that expansion, the PRWID should have ample capacity to handle potential future growth in water demand.

Wastewater treatment for the entire Carbon County portion of the Project Area is also handled by the PRWID. At present the wastewater treatment plant is operating well below its design capacity of four Mgd. Currently, typical flows at the treatment plant are approximately 2.1 - 2.2 Mgd (Richins 1996).

Public Facilities and Services in Emery County

The following information was derived from interviews with local government officials, including the Emery County School District and the Emery County Planning and Zoning Office.

Public Schools. Within the communities in the

Project Area portion of Emery County there are four elementary schools, one secondary school, and one high school. At present total enrollment in these schools is approximately 2,219 (Utah State Office of Education 1994). In terms of capacity, all of the elementary schools have room to accommodate additional students, while Canyon View Secondary School is near capacity and Emery County High School is presently over capacity.

Medical Facilities. The Emery County portion of the Project Area includes one emergency medical clinic and one nursing home and one residential care center. The nearest hospital, Castleview Hospital, is located in Price and has an 88-bed capacity.

Law Enforcement and Fire Protection. The Emery County Sheriff's Department and Utah Highway Patrol provide law enforcement services in Emery County. The Sheriff's Department currently includes approximately 37 officers and 25 patrol vehicles. The Utah Highway Patrol has approximately 6 patrol vehicles on duty in the county. Fire protection is the responsibility of the Special Service District, which is staffed by approximately 87 volunteer firemen, who are equipped with 30 fire trucks.

Utilities. In Emery County, electricity is provided by Utah Power and Light. Natural gas is provided by Mountain Fuel. Both of these utility services are modern and have adequate capacity for future growth.

Water Supply and Wastewater Treatment. Water and wastewater treatment services are provided by the Castle Valley Special Service District, which is currently operating well below its capacity.

Government Fiscal Conditions and Revenues from Coalbed Methane Activities

CBM developments contribute considerable revenue to various local, state and federal government entities through payment of royalties and taxes. The following is a summary of the types of revenues recently generated by the RGC project. Section 4.15 describes potential royalty and tax revenues that could be generated by the proposed project in the future.

State of Utah mineral lease royalties are collected for gas wells located on lands owned by the State of Utah. State royalty payments are based on the volume of gas produced. Depending on the type of state lands, royalties are either deposited into the state's school trust or the general fund. In 1995, state mineral lease royalty payments for the RGC project amounted to approximately $2,520,000.

Federal mineral lease royalties are collected for gas wells located on federally administered public lands. Federal royalty payments are also based on the volume of gas produced. Fifty percent of the revenue collected is returned to the State of Utah. The state then allocates one third of that revenue to the Permanent Community Impact Fund, from which cities in the Project Area, such as Price, Helper, and Wellington, can obtain funding from for various infrastructure-related projects. The state allocates another 25 percent to the county in which the gas was produced. In the Project Area, the local share of federal mineral lease royalty is paid to the Carbon County Road Special Service District to cover the cost of road maintenance and improvements. In 1995, federal mineral lease royalty payments for the RGC project amounted to approximately

$45,000 to the State of Utah, of which approximately $11,250 was paid to Carbon County.

Severance Tax is levied against the proceeds of the sale of gas over the previous year of production less federal and state royalties paid. In 1995, severance tax paid by RGC amounted to approximately $444,000. Conservation Tax is also levied against the proceeds of the sale of gas. In 1995, conservation tax payments amounted to approximately $36,000. Ad Valorem Tax is levied by Carbon County on facilities and/or improvements constructed by RGC. In 1995, ad valorem taxes paid by RGC to Carbon County amounted to approximately $387,000.

Sales and Use Taxes are also paid as a result of purchasing activities within the Project Area. Examples of purchasing activities that generate sales tax revenue include gravel, pipe, motor fuel, and other supplies purchased locally. Although no specific sales tax contribution is available for presentation at this time, it is estimated to be several thousand dollars annually.

3.15.2.5 Social Setting and Quality of Life

Residents of the Project Area enjoy numerous amenities associated with the abundance of open space accessible to the public. Wildlife viewing and hunting opportunities are available just minutes from home. A considerable network of roads and trails are available on public lands which support recreational activities, such as mountain biking, hiking, horse riding, and off-road vehicle use. Informal discussions with local area residents and elected officials has revealed that many residents of the Project Area value having quality recreational opportunities in the areas surrounding local towns and would like to see them protected.

In an effort to continue to attract retirees and other new residents to the Project Area, as well as promote tourism in the area, local government agencies, such as the Carbon and Emery County Planning Departments, Carbon County Future, and other organizations have expressed an interest in protecting the attractiveness of Project Area communities and surrounding open space areas. For CBM projects, such as the one proposed by RGC, the local government agencies have stated that by maintaining wellsites and project facilities in

such a way that surface disturbance and the debris are minimized, impacts to the attractiveness of the overall region could be minimized.

3.16 HEALTH AND SAFETY

Health and safety issues are addressed in Section 4.16.